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CANELLA ALBA.

BY JOHN P. FREY, PH.G.

From an Inaugural Essay.

After a detailed botanical description of the plant, and a histological description of the bark, accompanied by micro-photographs of the transverse and longitudinal section, the author states the result of his analysis thus : volatile oil 1.28, resin 8.2, mannit 6 to 8, ash 8.9 per cent., starch in considerable quantity, bitter principle, albumen and cellulose.

Ten pounds of well-selected bark was carefully distilled, and from the distillate 896 grains (1.28 per cent.) of *volatile oil* was collected, only a minute quantity being wasted. The oil was in two portions, one heavier and the other lighter than water ; the former was .70 per cent. and the latter .58 per cent. Both oils have a very strong, fragrant, somewhat camphoraceous odor, and a pungent, aromatic taste, the heavy oil being stronger in taste and odor. The odor of the bark is due to these volatile oils. The specific gravity of the heavy oil is 1.012 ; it is reddish-brown, begins to boil at 200°F., and the temperature gradually rises to 420°F., when it remains constant. It congeals at 38°F. The light oil has the specific gravity .988, is of a light straw color, begins to boil at 185°F. ; congealing point about 22°F. Both oils have a strong acid reaction. Nitric acid acts upon them violently, producing a red resinous mass which is insoluble in alcohol, ether and potassium hydrate. Sulphuric acid produces a deep blood-red color. Iodine dissolves in both oils slowly and quietly. Ferric chloride produces a deep blue color, showing the presence of eugenic acid or eugenol. By neutralizing the oils with potassium hydrate and distilling, the residue is a crystalline mass of potassium eugenate, from which, with sulphuric acid and distilling, eugenol is obtained as a colorless oily liquid, having a pleasant odor. The distillate of the oils with excess of potassium hydrate contained two colorless oils, one heavier

and the other lighter than water. The latter is neutral to litmus, and when treated with sulphuric acid turns to blood-red, but nitric acid and ferric chloride do not affect it. The heavy oil was in such small quantities that enough could not be obtained to ascertain its nature.

The *resin*, which was obtained by exhausting the drug with alcohol, evaporating and pouring the concentrated tincture into water, is of a pale yellowish color, destitute of odor and taste, soluble in ether and chloroform, slightly soluble in cold, more so in boiling solution of potassa; insoluble in turpentine or cold and hot water. The solution in potassa is precipitated on the addition of hydrochloric acid, and the alcoholic solution is precipitated by triplumbic acetate, but not by normal acetate. Both chloroform and ether solutions have a distinct acid reaction. When incinerated it yields a pale yellowish ash.

A crystalline principle was obtained by exhausting the bark with hot water, evaporating the solution to a very small bulk, and allowing this to stand in a warm place for a few days, when the whole mass became crystalline; it was then recrystallized from hot alcohol, the solution being filtered warm through animal charcoal; on the slow evaporation of the alcoholic solution rather large crystals will form. It crystallizes from water in colorless rhombic prisms, and from hot alcohol in fine needle-like crystals. They are freely soluble in cold and hot water; sparingly in cold, but readily in boiling alcohol, again crystallizing out upon cooling; insoluble in ether, and when heated on a platinum dish wholly volatilize. This is the crystalline principle which was called by some of the older writers "*Canellin*," but which Mayer and Von Reiche, in 1843, showed to be mannit. By a series of tests made in comparison with mannit from manna, I have found the two to be identical.

Wax was found in small quantities by treating the residue exhausted with alcohol with chloroform. Starch is present in considerable quantities, as was shown by the iodine test. The presence of gum was shown by a solution of triplumbic acetate and ammonium oxalate. Albumen is present and can be detected with mercuric chloride, or by coagulating with heat. The bitter principle is isolated with much difficulty; it is soluble in water and alcohol, and is not precipitated by triplumbic nor normal acetate. The bark is entirely free from tannin.

Water extracts 22 per cent. and alcohol 10 per cent. of the constituents of the bark. A tincture and fluid extract prepared some time ago remain perfectly clear. The tincture represents 10 per cent. of the

drug with a menstruum of alcohol 3 parts, water 1 part. The fluid extract was made with alcohol, and every cubic centimeter represents a gram of the drug. A solid extract was also prepared by exhausting the drug with alcohol 95 parts and glycerin 5 parts.

The ash was analyzed with the following results:

Calcium carbonate	83.00	} Insoluble in water.	88.40
Magnesium carbonate.....	1.70		
Aluminum and ferric oxides.....	2.60		
Calcium phosphate.....	1.10		
Potassium chloride.....	1.30	} Soluble in water.	13.10
Sodium carbonate.....	4.50		
Sodium sulphate.....	1.30		
Sodium chloride.....	6.00		
	101.50		101.50

THE FRUIT OF OPUNTIA VULGARIS, LIN.

BY WILLIAM W. LIGHT, PH.G.

From an Inaugural Essay.

The fruit begins to appear in July and ripens about the middle of October. It is about an inch in length, one-half to three-fourths of an inch in thickness, roundish pear-shaped, marked at the apex with concentric rings, and beset with rudimentary bristles in spiral rows. It is crimson externally, and internally of a still brighter color and frosty, sparkling appearance, it is covered with a thin tough skin, underlying which is a thickish pulpy rind. The berry-like fruit is filled with seeds arranged in longitudinal rows imbedded in and surrounded by a fleshy mucilaginous pulp and separated by white dissepiments. The seeds are from eight to twenty in number, in five rows alternately arranged with one capping-seed, to which the tough epidermis, in the centre of the umbilicated apex of the fruit, is attached. The seeds are flattish, circular and uneven, one-eighth to three-sixteenths of an inch in diameter and fully one-eighth of an inch through the thickest part. The seed is anatropous. The raphé forms a prominent bony margin nearly around the entire seed. The testa is cartilaginous, of uneven thickness and of a whitish color. The portion immediately surrounding the chalaza is very thin and is translucent. The membranous tegmen of the seed is of a shining blackish brown color, which is plainly

visible through the thin portion of the testa and gives that part of the seed a bluish black appearance. The embryo is imbedded in the oily albumen and has the cotyledous set contrary to the sides of the seed. It forms a little more than a complete circle and encloses a white, starchy centre. The fruit has an agreeable, slightly acid and very mucilaginous taste and a refreshing odor. It is frequently eaten, the seeds of necessity swallowed whole as it would be almost impossible to crush their shell-like testa between the teeth, or to separate them from their mucilaginous envelope.

The ripe fruit contains 68.2 per cent. of moisture. The ash amounted to 1.76 per cent. of the entire fresh fruit. It consists largely of silica, besides carbonates, chlorides, sulphates and phosphates, with potassium, sodium, aluminium, iron, magnesium and calcium. The seeds are about one-sixth the weight of the entire fruit.

The seeds and enveloping pulp were placed in a coarse linen bag to remove the mucilaginous matter by maceration in water. The mucilage had an acid reaction and possessed a beautiful light crimson color, which was completely discharged by heating on a water-bath or by the addition of an alkali.

The mucilage was not affected by oxalate of ammonium or concentrated solutions of ferric chloride or of sodium borate, but a precipitate was formed with both the normal and the basic lead acetate. The mucilage was precipitated by alcohol, obtained on a filter, dried in scales over a water-bath and preserved for further examination. The filtrate from the mucilage responded clearly to tests for glucose and pectous compounds but contained no tannin. The skins with a portion of the pulp left after the removal of the seed, were macerated in alcohol for several days the filtered product being a wine-red tincture of a pleasant fruit-like odor and acid reaction to litmus. This tincture was diluted with water and the alcohol distilled off on a water-bath. In this operation the wine-red color was discharged, the liquid assuming a green and then a light straw color. After removing the coloring-matter from the solution with benzin, a portion was precipitated by lead acetate. The precipitate did not behave as lead malate when heated under water, but was mostly soluble in solution of ammonium chloride. Another portion of the solution gave no precipitate with calcium sulphate, but with an excess of calcium hydrate, a white precipitate was produced. This precipitate was soluble in a solution of potassium hydrate, and the solution formed a gelatinous precipitate on

boiling which was partially dissolved again after the solution was cooled, thus proving the presence of tartaric acid. The precipitate was also soluble in acetic acid.

The filtrate from the lime precipitate was boiled, when a slight precipitate was formed insoluble in solution of potassium hydrate, showing the presence of citric acid. On adding solution of potassium permanganate it was not decolorized until upon the addition of potassium hydrate when the color was slowly changed to green.

The seeds, after having been dried, were reduced to powder, and macerated with benzin at a warm temperature for several days, then packed in a percolator and exhausted with benzin. The powder was dried and a portion of it was digested for several days in alcohol, packed in a percolator and exhausted with alcohol. In like manner they were successively exhausted with water, with a very dilute solution of potassium hydrate and with water acidulated with sulphuric acid.

The benzin product from the seeds was an amber-colored oil, which oil was purified by washing with water and afterwards with chloroform. It was then found to weigh 7.25 per cent. of the weight of the seed extracted, and to be of specific gravity .926. It possessed a slight disagreeable odor and insipid taste, insoluble in alcohol or chloroform, soluble in benzin and ether.

Treated with 25 per cent. nitric acid and a strip of copper turnings, the mixture assumed a red-brown color, but after a day became partly solidified and lighter brown. A quantity of the oil was saponified by potassium hydrate; the solution precipitated by and washed with sodium chloride, and the soda soap decomposed with hydrochloric acid. The fat acid was odorless and tasteless, of a translucent milky color and with slight acid reaction. Its lead salt seemed to be but slowly soluble in alcohol and insoluble in ether. The mother liquor of the soap contained glycerin.

The alcoholic percolate of the seeds was nearly colorless and inodorous and of but slight taste foreign to alcohol and gave evidence of the presence of glucose. It was evaporated to dryness, thoroughly washed with water, and with chloroform to remove a greenish extractive matter, when a red-brown resinous residue was left having a slight disagreeable odor, a slight nauseous, disgusting taste, fusible at 100°C., insoluble in benzin, chloroform or ether, but soluble in alcohol, diluted alcohol and carbon disulphide.

The percolates with cold and hot water contained glucose, starch, and albumen; but neither a glucoside nor an alkaloid could be detected.

The dried gum was found to be entirely insoluble in water or alcohol, but in the presence of an alkali it became soluble.

Of the powdered seeds extracted with benzin 75 grams were boiled with several portions of water until the water from them gave no coloration with iodine; the starch was converted into sugar; this was estimated by Fehling's solution, and the starch calculated from it giving 3.95 gram or 5.268 per cent.

The residuary powder was now boiled with diluted sulphuric acid for several hours, when the liquid contained glucose and on concentrating it transparent rhombic crystals were formed, which were insoluble in alcohol or ether, readily soluble in boiling water, and this solution was not precipitated by ammonium oxalate.

In reviewing the results of my work we find in this unpretending and unnoticed plant, not only a remarkable and peculiar histology, but interesting constituents which surely seem to possess sufficient individuality to deserve a closer investigation.

LUFFA AEGYPTIACA.

BY REINHARD J. WEBER, PH.G.

From an Inaugural Essay.

Description.—*Luffa aegyptiaca*, nat. ord. cucurbitaceæ, is indigenous to Egypt and Arabia, and is a large climbing vine, with a thin, but very tough light green succulent stem, attaining a length of from ten to thirty feet. The leaves are alternate and palmately lobed, of a light green color and almost destitute of taste. The flowers are monoecious; petals five, united below into a bell-shaped corolla; anthers cohering in a mass; ovary two-celled, style slender, stigmas three. The fruit is elliptical ovate, fleshy and indehiscent, with a green epidermis, longitudinally marked with black lines, varying from ten to fifteen in number; under each of these lines is found a tough woody fibre. The fruit attains a length of from six to twenty-five inches. I have seen a specimen of the fruit, grown in Allentown, Pa., which measured thirty-four and a half inches in length, and nine inches in diameter. When the epidermis is removed it presents a layer of interwoven woody fibres, which may be used like a sponge, being hard and rough when dry, and soft when soaked in warm or

cold water; they absorb the latter with the same facility as the ordinary sponge, and have the advantage over the sponge not to wear out by ordinary use for a number of years; hence, the name of "Vegetable Sponge," or "Wash Rag," and its use as a flesh glove. The seeds are numerous, and are almost flat, broadly ovate, three-eighths of an inch long. The testa is of a blackish brown color and rough, cotyledons almost flat, of a yellowish brown color and oily.

Analysis.—An infusion of the epidermis of the fruit (1 to 10) was made and tested for tannin, with tincture of chloride of iron, with sulphate of iron, and Russian isinglass, whereby a trace of tannin was shown, 100 grains of the epidermis thoroughly dried, yielded fifty-four per cent. of residue; on being incinerated at a low heat, the epidermis (dry?) yielded twelve per cent. of a dark gray ash, one half of which was soluble in water; the ash consisted of silica, carbonates and sulphates of potassium and calcium. The fibrous portion, after being incinerated, yielded sixteen per cent. of ash, partly soluble in water.

The fruit contains a large amount of mucilaginous substance, which yields a white precipitate with solution of subacetate of lead.

An infusion of the fibrous portion, when evaporated to a syrupy consistence, became gelatinous on cooling. The gelatinous mass had all the properties of bassorin, and was free from starch. One troy ounce of the epidermis was powdered, and successively exhausted with benzin, alcohol and water. The benzin solution yielded a small quantity of yellow coloring matter; the alcoholic tincture left chlorophyll and a little extractive, and the infusion gave twenty per cent. of slightly bitter extract.

One troy ounce of the powdered seeds was treated with boiling benzol; the green solution, on being evaporated, yielded two and a half per cent. of a brown, fatty oil, and twelve per cent. of a green mass. The latter, on being treated with very dilute hydrochloric acid, and evaporating the liquid, yielded a minute amount of crystals. Similar crystals were also obtained from the green alcoholic extract of the seeds previously exhausted with benzol. Water afterwards took up nothing of note.

Mode of preparing the fibrous portion.—The fruit is cut longitudinally on one side, stripped of the epidermis, the seeds are then removed, and the net work of fibres is washed thoroughly to get rid of the mucilaginous substance and dried. It is then ready for use. This fibrous portion is the only part of the plant, as far as I know, that has ever been in use.

PRACTICAL NOTES.

BY THOS. S. WIEGAND, PH.G.

Read at the Pharmaceutical Meeting, December 18, 1883.

Glycerite of Tar.—The omission of this glycerite from the new Pharmacopœia renders desirable a preparation that may be made without difficulty, and that will enable the pharmacist to furnish the various liquid preparations into which tar enters, in a cleanly, easy and expeditious manner. The glycerite made by the following formula being miscible with water in all proportions, and yielding a clear liquid, commends itself to the favorable consideration of pharmacists:

Oil of tar.....	f 3i
Alcohol.....	f 3ii
Glycerin and water, each.....	f 3iv
Magnesium carbonate, q. s., or.....	3vi

Mix the oil of tar with the alcohol, and rub these thoroughly with the magnesia to a smooth paste; to this add the glycerin and water previously mixed together; put the mixture into a well-corked bottle, and let it remain for several days, shaking it frequently; then filter through paper.

For prepaing *syrup of tar* add f 3ii of glycerite to f 3xiv of syrup.

Tar water may be made very readily by using 3ss of glycerite and water sufficient to make a pint.

Wine of tar may be made by using

Glycerite of tar.....	3iii
Sherry wine.....	3iv
Syrup.....	3ii
Water, enough to make.....	Oi

Tar ointment may be made much more easily and much smoother by using two drachms of oil of tar with six drachms of simple cerate.

Choleate or Choleinate of Soda.—Under this name a preparation made by evaporating purified ox gall has been introduced and used as a very gentle and efficient laxative in cases of torpid liver; it is thought to have less tendency to leave the bowels in a torpid state after ceasing to use it. The article is described in the National Dispensatory, but seems to have attracted less attention than it merits. It is recommended to be prepared by treating fresh ox gall with twice its bulk of alcohol; the mixture is shaken frequently during twelve

hours, the clear liquid is decanted, the alcohol distilled off, the remaining liquid filtered through well-washed animal charcoal and evaporated to dryness, or, when sufficiently concentrated, it is spread on glass plates exposed to a heat of about 140°F. till it scales. When thoroughly dry it should be preserved in well-stopped vials. It is given in doses of 5 to 10 grains, in the form of pills, as it is too unpleasant for any other form of exhibition. This method of dessication is quite important, as the preparation becomes very tough if dried in mass.

IMPURITIES IN CHLORIDE OF BARIUM.

BY A. E. BROWN.

Read at the Pharmaceutical Meeting, December 18, 1883.

While making a quantitative analysis of chloride of barium which had been sold as chemically pure, I found a deficiency of more than 2 per cent., each successive analysis producing the same result. A qualitative analysis for impurities was made as follows: to a concentrated solution of the salt was added chloride and hydrate of ammonium, when hydrate of aluminium was precipitated. No other impurities were found.

A quantitative analysis of the salt now showed that it contained 2.23 per cent. of chloride of aluminium. The formula $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ requires Ba 56.16, Cl 29.09, or BaCl_2 85.25 per cent.; H_2O 14.75 per cent.; total 100. The result of the analysis was BaCl_2 82.61, Al_2Cl_3 2.23, H_2O 14.75 per cent; total 99.59.

BLEACHING POWDER AND ANALOGOUS COMPOUNDS.

BY G. LUNGE AND P. NAEF.

As Kraut has recently taken up the subject of the constitution of bleaching powder, directing a polemical paper against the investigations of Lunge and Schaeppi ("Amer. Jour. Phar.," 1881, p. 608), the authors have repeated their former experiments, and those of Kraut, with a view of establishing the correctness of the formula $\text{Cl} \cdot \text{Ca} \cdot \text{OCl}$ first proposed by Odling. In their former paper great stress was laid on the complete and ready expulsion of all the chlorine in bleaching powder by carbonic anhydride in the presence of a little moisture, as militating against the presence of free calcium chloride. Kraut has

shown that calcium chloride, when treated with a mixture of hypochlorous anhydride and carbonic anhydride, forms calcium carbonate thus: $\text{CaCl}^2 + \text{Cl}_2\text{O} + \text{CO}_2 = \text{CaCO}_3 + 2\text{Cl}_2$, and concludes from this that calcium chloride is present as such in bleaching powder. But the authors point out that this reaction can equally be explained by the intermediate formation of bleaching powder and its subsequent decomposition thus: $\text{CaCl.OH} + \text{HOCl} = \text{H}_2\text{O} + \text{CaCl.OCl}$ and $\text{CaCl.OCl} + \text{CO}_2 = \text{CaCO}_3 + \text{Cl}_2$. To prove the correctness of their interpretation, a series of experiments were conducted in which pure hypochlorous anhydride was passed over pure calcium hydroxychloride, CaCl.OH , and the chloride; in every case the resultant material always contains a considerable proportion of bleaching powder (mixed with unaltered chloride and traces of chlorate), which can be subsequently decomposed by carbonic anhydride. Kraut's experiments are therefore inconclusive.

Secondly, Kraut having established that when lithium hydroxide is heated with chlorine, only half of it is attacked with formation of $\text{LiCl} + \text{LiOCl}$, draws the conclusion that as the lithium hydroxide is an integral part of the resultant compound, so calcium hydroxide is an integral part of bleaching powder. The authors, however, show that 80 per cent. of lithium hydroxide can be converted into the mixture $\text{LiCl} + \text{LiOCl}$, which is far less stable than bleaching powder in presence of excess of chlorine, in that it gives off oxygen, the presence of which could be recognized. On the other hand, the mixture $\text{LiCl} + \text{LiOCl}$ is far more stable than bleaching powder towards carbonic anhydride; at low temperatures it is practically unaltered, whilst at higher temperatures the mixture is converted partly into the chloride and chlorate, and is partly decomposed into the chloride and oxygen. The gas given off is not chlorine, but hypochlorous anhydride. As the properties of the so-called chloride of lithia differ so markedly from those of bleaching powder, a different constitution must be assigned to each. Arguments drawn from the behavior of the one compound have no bearing on the constitution of the other.

The analogous compounds of barium and strontium were also examined; that of barium is very unstable, whilst that of strontium is readily prepared, and resembles bleaching powder in its decomposition by carbonic anhydride.—*Jour. Chem. Soc.*, Nov., 1883, from *Annalen* [219], 129–161.

NOTES ON THE SODA INDUSTRY.

BY A. SCHEURER-KESTNER.

I. *Loss of Sodium in the Le Blanc Process.*—Eleven years ago the author established that the loss of sodium experienced in the Le Blanc process is proportional to the quantity of chalk employed. It is thus to the interest of the manufacturer to avoid excess of chalk, but at the same time to use a quantity sufficient to ensure perfect whiteness of the finished product. The author put forward the hypothesis that the loss is occasioned by the formation of a sparingly soluble calcium-sodium carbonate; this view has been confirmed by the researches of Jurisch, Watson Smith, and Liddle and Reidemeister. The latter has found in the lixiviating vats crystals of the composition of gaylussite, $\text{Na}_2\text{CO}_3, \text{CaCO}_3, 5\text{H}_2\text{O}$, a compound insoluble in sodium carbonate and hydrate, mixed in the proportion in which they occur in the crude lye; it dissolves slowly in water, the crystals becoming opaque from the ready dissolution of the sodium carbonate.

Reidemeister has further shown that gaylussite is formed not only in the lixiviating vats, but also in the anhydrous state in the soda pans during fusion; it probably also occurs in the residues, and the deposit of the caustification process, but its state of division prevents its detection and isolation.

II. *Presence of Vanadium, Fluorine, and Phosphorus in Crude Soda-lyes.*—In 1864 Rammelsberg detected the presence of vanadium and of sodium phosphate, $\text{Na}_3\text{PO}_4, 10\text{H}_2\text{O}$, in crude soda-lyes; Baumgarten, a short time after, found fluorine existing as a double sodium phosphate and fluoride, $\text{NaF}_2, \text{Na}_2\text{PO}_4, 18\text{H}_2\text{O}$. From the red mother-liquors in the manufacture of the carbonate and hydroxide, Rammelsberg separated crystals, either white, or red from the presence of iron, which proved on analysis to be identical with Baumgarten's compound; they also contained about 1.2 per cent. of vanadic acid. It is probable that the chalk and coal furnish the vanadium and phosphorus; the origin of the fluorine is quite uncertain.

III. *Loss of Sodium in Caustification.*—The author has previously shown that the loss of sodium in caustification arises from the same cause as the loss of sodium in the Le Blanc process, *i.e.*, the formation of a double sodium calcium carbonate. Analyses by Jurisch (*Chem. Indust.*, 1880, 377) would lead to the conclusion that this loss is less

the greater the excess of lime; but this statement is in direct contradiction to experience. According to Jurisch, the density of the liquor for caustification should not exceed 14° Baumé; the author, however, points out that under ordinary atmospheric pressure it is impossible to caustify denser liquors than these, for the reaction became incomplete owing to a commencement of a reverse chemical change. The author also criticises Jurisch's statements as regards the amount of combustible substance required for the evaporation of caustic soda of various densities.

In the remainder of the paper no new chemical facts are detailed; the author quotes, and offers some critical remarks upon Weldon's statements as regards the extraction of ammonia from coal, the use of pyrites from Rio Tinto for the manufacture of sulphuric acid, and the total production of sodium carbonate from the Le Blanc and the ammonia processes throughout the world.—*Jour. Chem. Soc.*, Sept., 1883.

ACIDUM OLEICUM—OLEIC ACID.

BY DR. E. R. SQUIBB.

A yellowish oily liquid, gradually becoming brown, rancid and acid, when exposed to the air; odorless or nearly so, tasteless, and, when pure, of a neutral reaction. Sp. gr. 0.800 to 0.810. Oleic acid is insoluble in water, but completely soluble in alcohol, chloroform, benzol, benzin, oil of turpentine and the fixed oils. At 14° C. (57.2° F.) it becomes semi-solid, and remains so until cooled to 4° C. (39.2° F.), at which temperature it becomes a whitish mass of crystals. At a gentle heat, the acid is completely saponified by carbonate of potassium. If the resulting soap be dissolved in water and exactly neutralized with acetic acid, the liquid will form a white precipitate with test solution of acetate of lead. This precipitate, after being twice washed with boiling water, should be almost entirely soluble in ether (abs. of more than traces of palmitic and stearic acids). Equal volumes of the acid and of alcohol, heated to 25° C. (77° F.) should give a clear solution, without separating oily drops upon the surface (fixed oils).—*U. S. P.*

Just now this acid seems to be an important addition to the Pharmacopœia, and a good description and tests much needed. But those given above, which are most definite and most characteristic, do not apply to the oleic acid, which is generally accessible, and which has been exclusively, or almost exclusively, used in this country since the oleates were introduced here. And if this description and tests is to apply in future, the entire practice must be revolutionized, and this writer does not know of such an oleic acid, nor where it is to be

obtained. Both the pharmacy and the therapeutics of the acid and the resulting oleates have been based on a substance which, though comparatively easily obtained, would not be admitted to use under the officinal description and tests, and yet upon this substance almost, if not all the medicinal results have been obtained thus far.

When the oleates first attracted much attention here the Chairman of the Committee of Revision of the Pharmacopœia of 1880, published in "The American Journal of Pharmacy" for January, 1873, vol. xlv., p. 2, a process for obtaining oleic acid of sufficient purity for these externally applied oleates, from the commercial acid or "red oil" of the candle makers. And this process, with slight modifications by the writer and others, has been followed ever since, and has supplied all, or nearly all the acid used in medicine up to this time. The authority for this statement is, that the writer believes himself to have been much the largest user of oleic acid in this country up to a late date. Having commenced to make the oleates from this acid, in 1871, when a single barrel of the acid satisfied the demand for a year, these oleates, without the least advertising or drumming of any kind, have steadily increased in use until this year, when fifteen barrels was insufficient, and many orders for the acid, in large quantities, to supply other makers of oleates, had to be declined. Only within the past year or two has the demand for oleates been sufficient to attract the attention of "the trade," and now that they are being largely advertised, the writer does not know what acid is being used, except that he has freely told every one who has asked, the source of his own supply, and his method of purification, and except that he has supplied several makers of oleates.

The candle makers use all sorts of fats, good and bad, that will yield them a firm, solid, stearic acid, and many of these fats they buy cheaply in the form of various kinds of refuse; and they continue their process all the year round. Much of the fat is rancid when they use it, and all through the summer it is all apt to be more or less rancid. But they do not get enough scrap fat, and inferior stock, and often have to use good fresh and sweet fats. By only going to them, in cold weather, and by watching for opportunities when they are working on good materials, and by paying full prices for a little extra pains, cleanliness, etc., a crude acid can be had in any quantity that is quite proper for medicinal uses. This is the best, and perhaps exceptional quality, of the "red oil" of the market, and when this is

distilled in a current of superheated steam, it becomes a pale brownish yellow oily liquid, transparent at summer temperature, but at $15^{\circ}\text{C} = 59^{\circ}\text{F.}$ it deposits about half its volume of crystalline white palmitic or margaric acids. The transparent portion separated and subjected to a temperature of about $10^{\circ}\text{C.} = 50^{\circ}\text{F.}$ deposits an additional portion of the solid acids. These, when carefully filtered out at or below this temperature, leave the oleic acid which has been used and sold by this writer.

It is a pale brownish yellow, oily liquid, varying in depth of color between that of pale and ordinary sherry wine, sometimes as deep in color as almond oil, and it becomes slightly browner by age. Thus far it practically agrees with the Pharmacopœia description. But it is never neutral to test paper, but always acid, and it does not become rancid and acid to any considerable extent by any ordinary exposure. A specimen, exposed to the air in a shallow basin for two or three weeks, changed very little in sensible properties, and in its action on litmus paper. A little oxyoleic acid was present at first, and probably increased a little, but 1 cc. of 10 pc. solution of ammonia in 50 c.c. of water, shaken with 50 cc. of the oleic acid, deprived [it of its acid reaction, both in that portion which had been exposed and that which had not. Therefore, the proportion of oxyoleic acid must be so small as to be insignificant, and yet is sufficient to give an acid reaction always.

This oleic acid is not "odorless or nearly so," but has a peculiar, distinct odor that is not that of rancid fat, but is suggestive of that odor, though it is not disagreeable to most persons, and the taste is like the odor, but it is not the acrid, almost pepper-like taste of rancid oils, though it gives a distinct after taste of acidity in the fauces. The s.g. compared with water at 4°C. is not "0.800 to 0.810," but is .8955 at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$, and .8896 at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$ It is completely soluble in alcohol, but the other solubilities stated were not tried. "At $14^{\circ}\text{C.} (57.2^{\circ}\text{F.})$ " it does not become semi-solid, but remains transparent at 4° to 5°C. It may not be of any great disadvantage to the oleic acid for medicinal uses, to leave in it the very considerable amount of palmitic, margaric or other acids of higher melting points permitted by this test, but the test simply rules out an oleic acid which has less of these other acids in it. The small proportion of oxyoleic acid doubtless lowers the solidifying point of all the fatty acids, but not to a very great extent. The oxyoleic acid is

also objectionable, therapeutically, because it is an irritant, and therefore there should be a limit set to the amount which is permissible.

The test given for the absence of more than traces of palmitic and stearic acid will never be satisfied by any oleic acid which the writer has ever seen which becomes semi-solid at $14^{\circ}\text{C.} = 57^{\circ}\text{F.}$, since all the solid portions at this temperature are margaric or palmitic acids. Another point which invalidates this test is that a soap made with a carbonated alkali as directed, without boiling, will always give a precipitate with acetate of lead, which will contain carbonate of lead, and this of course not being soluble in ether, would be accepted as palmitate or stearate of lead, when neither the one nor the other was present.

The principal differences between the oleic acid which has hitherto been used and that now required by the Pharmacopœia are, the odor, taste, acidity, specific gravity, and solidifying point. And the greatest of these differences is in specific gravity. All the others may be understood as being differences between a chemically pure acid and one that is less pure, and the question would be whether a chemically pure substance was needed for these external uses, after all the experience made with the oleates has been from an acid which, though of good quality, is not chemically pure. But the very great difference in specific gravity must mean more than this, and it led the writer to make the following investigations:

On referring to authorities, it was found that Gmelin quotes Chevreul as his authority, and gives $\cdot 898$ at 19°C. Watt's Dictionary of Chemistry also quotes Chevreul, but gives $\cdot 808$ at 19°C. In Wurtz Dictionnaire de Chimie, the article on oleic acid is written by P. Schutzenberger, and gives $\cdot 808$ at 19°C. Other authorities seem to copy almost exclusively the latter figures, and the temperature being the same, it seems probable that all come down from Chevreul who wrote seventy years ago, and that some one has made a mistake. Allen, however, gives $\cdot 900$ to $\cdot 905$ for commercial oleic acid.

A specimen bottle of German oleic acid, from a very good maker, costing, wholesale, \$11 per pound, not labelled "C. P.", was carefully examined in comparison with the above-mentioned acid from red oil. It was of the color of pale sherry—not lighter than the best specimens from red oil—had the same peculiar odor and the same acid reaction. The s. g. under the same conditions of standard and temperature was $\cdot 8923$ at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$ and $\cdot 8864$ at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$; and it

answered all the other tests of the Pharmacopœia as well, but no better than the red oil acid, and in all probability it contained quite as much oxyoleic acid.

Cotton seed oil, olive oil, refined lard oil and almond oil were then each saponified, the soaps decomposed by tartaric acid, and the oleic acid separated from the other fatty acids in all, except the cotton seed product. This contained so little oleic acid that it was not separated.

The work was not done with critical accuracy, but only with practical accuracy, such as would be applied on a manufacturing scale, and the results were briefly as follows:

The olive oil gave an oleic acid which was almost odorless, was neutral, and when sufficient palmitic acid was left in it, was semi-solid at 14°C. , but the proportion of palmitic acid to produce this was very considerable, so that a large proportion of the lead salt was insoluble in ether. The s. g. at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$ was $\cdot 9026$; at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$ it was $\cdot 8964$. The s. g. was taken with enough palmitic acid in it to be not quite transparent at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$

Refined lard oil of very good quality gave an oleic acid which was perceptibly different in some sensible properties from the acids from the olive and almond oils. The difference is, however, difficult to describe. It felt a little smoother and softer to the touch, and a little of it seemed to spread over greater surfaces, and it seemed that the hands became dry more quickly when wetted with it. Some comparative trials of the rate of absorption were made, but they were not accurate enough or definite enough to be stated. The lard acid was nearly odorless, but not tasteless, and gave the irritant acrolein-like impression or after-feeling in the fauces. It was neutral to litmus paper, and only lost its transparency when cooled to $5^{\circ}\text{C.} = 41^{\circ}\text{F.}$ The s. g. at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$ was $\cdot 9041$; and at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$, $\cdot 8976$.

The mixed acids from the almond oil when cooled to $8^{\circ}\text{C.} = 46\cdot 4^{\circ}\text{F.}$, and the oleic acid filtered out at that temperature, gave an acid of a rich, deep brownish yellow color, deeper than that of the oil from which it was made, and deeper than any of the other acids. It was nearly odorless and tasteless, and not quite neutral to litmus paper. It remained entirely transparent at $4\cdot 4^{\circ}\text{C.} = 40^{\circ}\text{F.}$, and was not cooled lower than this. Its s. g. at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$ was $\cdot 9100$; at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$, $\cdot 9039$. This acid was then again saponified with caustic soda, and a lead salt made from it by decomposition with solution of acetate of lead. The washed lead salt was exhausted by ether, the

etheral solution filtered, and the ether distilled off in a water bath gradually heated to boiling, and boiled actively for half an hour. The acid was then of a pale yellow color, but had a fatty odor. Transferred to a flask which it filled to the middle of the neck to diminish contact with the air, it was then heated in a sand bath to $210^{\circ}\text{C.} = 410^{\circ}\text{F.}$ At about 100°C. vapor was given off with the appearance of gentle boiling, and this boiling continued to the end of the heating, diminishing as the temperature arose, and had not entirely ceased, but nearly so, when the heating was discontinued. The vapor given off had at first a slight odor of ether, and afterward seemed to be mainly steam with a fatty odor. Toward the end of the heating a visible vapor came off with an odor suggesting acrolein, and as this evidence of decomposition became distinct and unmistakable, the heating was arrested before the bubbles of vapor had entirely ceased to arise from the bottom and sides of the flask. The flask was then corked and cooled. During the heating, which required about an hour and a quarter for about 150 grammes of the acid, the color became much deeper, so that the acid was much deeper in color than the original almond oil, and quite brown; and the volume was reduced by 5 to 8 p. c. (estimated). The s. g. at $15^{\circ}\text{C.} = 59^{\circ}\text{F.}$ was .8984, and at $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$, .8917.

When cooled down to $3.4^{\circ}\text{C.} = 38^{\circ}\text{F.}$ it congealed at the surface first, and during the congelation the temperature rose to $5.2^{\circ}\text{C.} = 41.4^{\circ}\text{F.}$, and the whole became a soft solid mass from which no liquid would flow.

A part of the same acid which had been saponified only once, as before-mentioned, the soap decomposed with tartaric acid in excess, and the resulting mixed acids separated by cold at $8^{\circ}\text{C.} = 46.4^{\circ}\text{F.}$ when cooled remained perfectly transparent to $2.5^{\circ}\text{C.} = 37^{\circ}\text{F.}$, and then began to crystallize in distinct white groups on the sides and bottom of the flask. These groups were few and small, and the mass of acid did not crystallize at that temperature. It was therefore concluded that these small groups were palmitic acid crystallizing out. Each then stood for eight hours at a temperature of $3^{\circ}\text{C.} = 37.4^{\circ}\text{F.}$ when the last portion was filled with crystals, though still liquid, and had a temperature of 4.6°C. The portion which had been resaponified, ether extracted and heated, was so nearly solid that the thermometer could only just be pushed through the mass, and its temperature was 4.4°C.

The marked difference in s. g. of this acid, before and after the second

saponification, is doubtless partly due to the palmitic acid present in the first, and entirely absent in the last portion. But the boiling off of so much vapor in the heating of the latter portion, and the considerable reduction in quantity, leads to the inference that before heating the acid is a hydrate, and by heating parts with a molecule of water. If this be the case, the difference in s. g. before and after heating would be accounted for.

These data show conclusively that all the authorities referred to give a very erroneous s. g. for oleic acid, excepting Gmelin, while this, as well as the other authorities, quote from Chevreul; and it is not at all strange that the *Pharmacopœia* should have fallen into this very popular error. It seems pretty clear, too, how the error occurred. Some printer or copyist has probably made Chevreul's .898 into .808; not a difficult thing to do, especially when the old style figure 9 is used, as it may have been seventy years ago. It is rather curious that no redetermination of this s. g. has reached the prominent authorities referred to, since doubtless such redeterminations of so important a substance must have been often made.

The *Pharmacopœia* is, however, wrong in its temperatures of solidification, since by these it permits a large proportion of palmitic acid to be present in the oleic, and afterward gives a hypercritical test for excluding palmitic acid almost entirely.

Not one of the specimens of oleic acid made for this investigation was either pale yellow in color, or was nearly odorless or tasteless, and the after taste, in the fauces, was in all cases very pronounced.

The general practical conclusion reached here is that for medicinal uses a well prepared oleic acid from red oil is unexceptionable and should be continued in use, and the writer will still continue to use it, although he, with all others who do use it now, must state on the label that it is *not* the oleic acid of the U. S. P. of 1880. Then those who can get an acid which will answer the official tests will of course not take this, nor be liable to be deceived by it.

It is possible, and perhaps even probable, that oleic acid from animal fats is better for use in the animal economy than one from vegetable fats, for the same reason that ointments have always been made from animal fats rather than vegetable. But this has been neither proved nor disproved. It is, however, a more important question now than ever before, since the most important use of oleic acid now is, as a vehicle for the introduction of medicinal agents into the circulating

fluids within, to effect the general economy. As local agents for the treatment of external and local affections, such as diseases of the skin, the question of the most prompt and rapid absorption is of comparatively little consequence. But when quinia, morphia, mercury, etc., are to be introduced into the blood for general therapeutic effect, the most prompt and rapid absorption is very important. And, from this point of view, if the oleates are even moderately successful, as they now appear to be, their utility has as yet only begun to be realized in medicine.

The rapidity with which they are absorbed from the surface of the body is certainly very remarkable, and seems to vary very little in different portions of the skin, but varies very much in different conditions of health and disease. A moist skin, and especially the leaky skin of collapse, or of low vitality, and a sweating surface, absorb oleates badly or not at all; and from this condition to that of the very prompt absorption of health, there are, of course, all possible degrees of activity and inactivity.—*Ephemeris I*, p. 399–405.

VEGETABLE TALLOW FROM SINGAPORE.

BY E. M. HOLMES, F.L.S.,

Curator of the Museum of the Pharmaceutical Society.

Mr. R. Jamie of Singapore, in a letter accompanying some interesting donations lately presented by him to the Museum, has called my attention to this substance as possessing the valuable property of not readily turning rancid. He remarks concerning it: "The vegetable tallow never turns acid, and when the white kind is got, which is seldom, it makes very good ointment, simply with the addition of olive oil." At the ordinary temperature this tallow is a white friable solid, softening into a pasty condition when rubbed between the fingers and ultimately melting sufficiently to be rubbed in without leaving the hand very greasy. It has a very slight nutty odor and taste. It would seem therefore to be peculiarly suitable for camphor balls, suppositories and pessaries; for the latter its slowness in melting seems to peculiarly fit it.

Mr. E. Fielding at my request has made a few preliminary experiments as to its melting point and solubility in various solvents. He reports as follows: "At 65° F. it remains a little solid; between 82° and 104° F. it has the consistence of flour paste; it fuses at about

118° F., but remains transparent and liquid at 112° F. It is soluble in about an equal weight of cold ether; it is sparingly soluble in cold acetic ether and acetone, but very soluble in these liquids when heated, the greater part being precipitated on cooling; it dissolves in half its weight of cold chloroform, but mixes with one third of its weight of the same liquid when heated. In bisulphide of carbon, either cold or hot, it is extremely soluble. In cold benzol it is soluble to the extent of about 1 in 4. In hot benzol and petroleum spirit (hexane or heptane) it dissolves in all proportions, but the solution gelatinizes on cooling. It is very soluble in cold turpentine and dissolves in it when heated in all proportions. In alcohol it is soluble to the extent of about 1 in 30 when cold or 1 in 20 when hot, and in isopropyl alcohol it dissolves to the extent of about 1 part in 25 when cold, and 1 part in 4 when hot." Mr. Fielding thinks it may be compared in many respect with the fat of *Pentadesma butyracea* (*Uchiaceae*), which should, however, judging from its natural odor, be more nearly allied to kokum butter (*Garcinia purpurea*.)

According to a cutting from the *Java Bode* newspaper, sent to me by Mr. Jamie, the vegetable tallow, known as Minyak Tangkawang, or Minyak Sangkawang, is obtained from the seeds of one or more trees of the genus *Hopea*, found in the S. and E. division of Borneo, chiefly in the neighborhood of Qualla Kapuas, and on the west coast in the districts of Sambas and Mampawa. The Dyaks call the fat Kakawang and the tree which yields it Upu Kakawang. This tree is one of the giants of the forest. Several species of the genus appear to be used. Of these *Hopea splendida*, the Tongkawang Tonggul, is also called by the natives Dammar Tangkawang (because the bark yields a dammar.) The timber is used by the Dyaks for making their prahus, as it is proof against the influence of water. The bark also yields a red dye. This tree grows on alluvial fat clayey ground on the banks of great rivers. *Hopea aspera* grows on the higher mountain tracts, principally on the declivities of Mampawa, and is distinguished by the hairiness of the stems.

The preparation of the fat is very simple. When the ripe fruit falls on the ground, it is collected and allowed to germinate a little in a moist place. It is then dried in the sun until it becomes brittle. The fruit is then deprived of its shell and put into a rattan or bamboo basket suspended over boiling water. When it has been well steamed, the fruit becomes soft and plastic like dough. The fat is then expressed

by squeezing the doughy mass in a cloth and is poured into joints of bamboos, by which it receives the cylindrical form in which it is met with in commerce. Some Dyak tribes press the fruit by means of two beams. But it is probable that by neither of these processes is all the fat obtained.

The trees begin to yield when they are about eight or ten years old and the crops are somewhat irregular, but every four or five years an extraordinarily large crop may be counted upon, the fruit being ripe in December and January. According to "Spon's Encyclopædia" (p. 1413), about ten species of *Hopea*, yielding oil seeds differing much in size, are recognized by the natives of Borneo, three of these being common in Sarawak. The fat is also prepared in Java and Sumatra. By the natives the tallow is used for culinary and lighting purposes.

Although the tallow has not as yet been turned to account in pharmacy in this country, there is no reason why its fitness for medical purposes should not be experimented upon, the fat being a regular article of commerce. As far back as 1856, 651,586 kilos were imported into Singapore, and now several thousands of piculs go yearly to Singapore and are exported thence to England for use as a lubricating agent. For this purpose it has proved most valuable, especially for steam machinery, far surpassing even olive oil. In Manilla it has been employed in the manufacture of candles and found to be very valuable for this purpose. There are doubtless many other purposes in the arts to which the fat might be applied. It contains glycerin and about 95 per cent. of saponifiable matter which has less olein in it than animal fat. The tree is certainly also worthy of the attention of colonial planters since it yields fat, dye, timber and probably also resin, and the demand for the fat alone, when it is better known and prepared in a pure state, will probably far exceed the native supply.—*Phar. Jour. and Trans.*, November, 1883, p. 401.

Boracic Acid not Harmless.—There is a case reported in *Schmidt's Jahrbücher* following the use of an injection of a four per cent. solution for chronic diarrhœa, and the Medical Record reports a death supervening upon its external use in an ulcer. The cases teach us that boracic acid is not so harmless as is usually supposed, and warn us to be cautious in its use, either pure, or in such combinations as borax, boro-glyceride, etc.—*Louisville Med. News.*, November 24, 1883.

THE PURGATIVE PRINCIPLE OF CROTON OIL.¹

BY HAROLD SENIER,

Fellow of the Institute of Chemistry and of the Chemical Society.

In a paper read before this Society in March, 1878,² I pointed out that English pressed croton oil of undoubted genuineness could be separated by alcohol into two parts. The part soluble in alcohol was, or contained the vesicating principle, while the part insoluble in alcohol was entirely non-vesicating. Further experiments towards the isolation of this vesicating principle I have recorded in another paper. With respect to the other prominent property of croton oil, its purgative activity, I at that time was led by the opinion of therapeutists to believe either that this action was due to the vesicating principle or that it resided in the same portion of the oil—that portion soluble in alcohol; this, however, was not then determined. I now find that the purgative constituent does not exist in the alcohol-soluble vesicating oil, but is entirely in the alcohol non-soluble, non-vesicating oil. This I determined in the first place by experiments on myself and others, and more recently the therapeutic action of this oil has been studied by my friend Dr. J. W. Meek. My experiments consisted first, of the administration of the non-vesicating oil in doses of $\frac{1}{10}$ minim, increased to $\frac{1}{2}$ minim; if this oil contained the whole of the purgative principle, this quantity would be equivalent to about $\frac{1}{8}$ to 1 minim of commercial croton oil. The oil used in these experiments was carefully freed from traces of the vesicating oil by repeated washings with alcohol until nothing more was dissolved. It was administered in the form of pills, and I found magnesium carbonate and extract of hyoscyamus convenient excipients. The general results from these experiments were, briefly, from the smaller doses a mild, and from the larger doses a powerful purgative effect, unaccompanied by any unpleasant symptoms. I supplemented these experiments by the administration of similar doses of the vesicating oil under similar conditions and obtained no purgative action, but a considerable amount of irritation in the alimentary canal accompanied by nausea.

In conclusion, I do not think I am exaggerating the practical out-

¹ Read at an Evening Meeting of the Pharmaceutical Society of Great Britain, December 5, 1883.

² *Pharm. Journal*, [3], viii., p. 705.

come of these experiments when I say, that subject to the results of more extended therapeutic experiments, this non-vesicating croton oil, either in its present form or in the more concentrated form in which I hope to obtain it furnishes a useful, safe, speedy and pleasant purgative.

Dr. Meek describes the result of the experiments conducted by him as follows :

Report on the Physiological Action of the Non-vesicating Portion of Croton Oil.

BY JOHN W. MEEK, M.D., LOND.

In order to try the physiological effects of the non-vesicating portion of croton oil, Mr. H. Senier was good enough to supply me with some of that portion of the oil as isolated by him. It was made into the form of pills with extract of hyoscyamus.

Given to healthy adults in doses containing the non-vesicating portion of one-tenth of a minim of ordinary croton oil, beyond slight nausea and some sense of discomfort no appreciable effect was produced; but I found that doses containing the non-vesicating portion of half a minim of croton oil acted as a powerful purgative in from three to six hours from the time of administration. In some of the cases the oil caused griping, but not in all. The motions were usually of a loose character, though not containing a large amount of fluid. The bowels were usually opened two or three times at intervals of an hour or more between each action.

In the doses above mentioned, beyond the action on the alimentary canal, no other physiological effect was observed in any of the cases. —*Pharm. Jour. Trans.*, Dec., 1883.

THE VESICATING PRINCIPLE OF CROTON OIL.¹

BY HAROLD SENIER.

Fellow of the Institute of Chemistry and of the Chemical Society.

In a former paper² I gave the results of an investigation into the action of alcohol on croton oil, and found that under certain conditions it separated the oil into two parts; the one part vesicating, the other non-vesicating. I briefly described the vesicating oil and also the non-vesicating oil, which I have since shown to be purgative.

¹ Read at an Evening Meeting of the Pharmaceutical Society of Great Britain, December 5, 1883.

² "*Pharm. Jour. and Trans.*," March 9, 1878.

In another paper I have given the results of my work, so far, on this purgative oil. In this paper I show, in the first place, more exactly what the conditions are which affect the solubility of croton oil in alcohol, maintaining and extending my previous conclusions. In the next place, I proceed to determine whether the oil soluble in alcohol is itself the vesicating principle, or what part of it has that power.

The Solubility of Croton Oil in Alcohol.—When alcohol (sp. gr. .794 to .800) is mixed in equal volumes with English pressed croton oil, perfect solution takes place, the mixture being permanent at all ordinary temperatures, and this is equally true when any less quantity of alcohol is used. When, however, the proportion of alcohol to croton oil becomes as seven volumes to six, or any larger proportion of alcohol, then a part of the croton oil separates. This part varies in quantity, in the case of different samples of oil, in accordance with the conditions noted in my former paper. It is an interesting fact that that portion of the croton oil which separates when the alcohol is in excess is afterwards insoluble in any proportion of alcohol. But that portion of the oil dissolved by alcohol is, when separated, soluble in all proportions.

In the discussion following my former paper, Professor Redwood remarked on an apparent discrepancy between my results on this point and some experiments made by himself some years previously.

In the experiments reported by Professor Redwood, croton oil and alcohol were used in equal volumes only and found perfectly miscible. This result, so far as it goes, agrees exactly with my own, and no doubt if Professor Redwood had employed other proportions than those given his results would also have coincided with mine. The usual statements regarding the solubility of croton oil in alcohol as found in many textbooks, and incidentally revived by Mr. A. H. Allen in his recent paper on "The Chemistry and Examination of Fixed Oils"¹ are shown by my experiments to be inaccurate.

Search for the Vesicating Principle.—Some of the characters of the alcohol-soluble croton oil, which has been shown to contain the vesicating principle I have described in the previous paper, to which reference has already been made. The more important of these characters, together with others since observed, are as follows:—At 60°F. this oil is of a brown color, and holds in suspension a number of acicular crystals soluble on warming. It has a strong characteristic smell of croton oil, a persistent burning taste, and readily produces pustules

¹ "Jour. Soc. Chem. Ind.," February 28, 1883.

when applied to the skin. It has an acid reaction and a sp. gr. of .987.

Solvents were first tried as a means of further separation. Water, alcohol of various strengths, benzol, chloroform, ether, petroleum naphtha, etc., were tried, at different temperatures and in various proportions, but the results did not indicate a method of further separation. The oil was then subjected to distillation, alone, with acids, alkalies, and by the passage through it of heated steam. Several distillates were thus obtained, but they were all non-vesicating. The oil therefore contains no free volatile vesicating principle, neither does the vesicating activity exist in a combined volatile alkaloid or alcohol.

To determine whether the fatty acids or alcoholic radical contained the vesicating principle, the oil was subjected to saponification, first of the free fatty acids. 50 grams of oil were digested on a water-bath for one hour, with $12\frac{1}{2}$ grams of sodium bicarbonate and 10 grams of water. The resulting soapy mass was agitated with petroleum naphtha, and the whole placed on a filter and repeatedly washed with the same solvent. The filtrate containing the unsaponified neutral oil, when evaporated and dried, weighed 38.7 grams; the difference, representing free fatty acids, being 11.3 grams or $22\frac{1}{2}$ per cent. of the alcohol-soluble oil. The soap left on the filter was diffused in hot water and decomposed with sulphuric acid. The free fatty acids which separated in white flocculi were collected and washed, dissolved in alcohol and crystallized. In this state their melting point indicated fairly pure palmitic acid, which was devoid of any vesicating property. The vesicating activity does not, therefore, reside in the free fatty acids.

Returning now to the neutral oil, this was saponified by 10 grams of caustic soda and 20 grams of water. The soap on cooling rose to the top as a hard cake, from which the aqueous solution containing the alcohol radical was easily separated. This on concentration gave no evidence of containing any vesicating principle. The soap was diffused in hot water, decomposed with sulphuric acid, and the free fatty acids separated. The soap previous to decomposition had no tendency to vesicate, but the free acids when liberated were strongly vesicant.

It was now evident that the vesicating principle was among the fatty acids; the next experiments were directed, therefore, to their separation. This has at present been accomplished only in an approximate manner, but the subject presented so many difficulties that it seemed advisable to publish the results so far obtained.

Many processes were applied to the separation of these acids, which

after much time and careful working gave only negative results. The description of these I shall omit. The following gave the only results from which even general conclusions could be drawn:—First, separation by means of the different congealing points of the glycerides of the fatty acids. Second, separation by means of the different solubilities of their lead salts in alcohol and ether. Third, separation by fractional saponification. Fourth, separation by fractional decomposition of the soda salts. The first of these separations was accomplished by filtration and slight pressure through a plug of tow in a jacketed funnel surrounded by refrigerating mixtures. The manner of accomplishing the other three separations does not require a special description.

The conclusions from the results of these processes were briefly as follows:—First, the vesicating principle is contained in those acids having the lowest melting points. Second, the lead salt is soluble in ether, but not at all, or very slightly, in alcohol. Third, it is contained in those acids least readily saponified by alkalis. Fourth, it is contained in those acids first liberated when the alkali soap is decomposed by acids.

In the next experiment the acids were separated into four groups, as follows:—First, those having ammonia salts insoluble in alcohol (palmitic acid). Second, those (after removal of group 1) which are precipitated from alcoholic solution by magnesium acetate. Third, those which, in the absence of groups 1 and 2, are precipitated as insoluble barium salts in alcoholic solution (oleic, etc.). Fourth, those whose barium salts are soluble in alcohol. The fatty acids were dissolved in alcohol and saturated solutions of the reagents were added. The precipitate in each case was washed on a filter with cold alcohol. The yield of acids in each group was, in round numbers, group 1, 15 per cent.; group 2, 20 per cent.; group 3, 40 per cent., and group 4, 25 per cent. of total fatty acids in the neutral alcohol-soluble croton oil. The acids of groups 1, 2 and 3 were entirely inactive as regards vesicating effects, but those separated in group 4 were highly vesicant. These acids when separated are of a dark brown color, and remain liquid at 50°F. They may be further purified by saponification with plumbic oxide, solution of the soap in ether and regeneration with an acid. In this state they are rendered much more active. Taking into consideration the low melting point and the solubilities of the metallic salts, together with the results of the experiments on the separation of

the acids by the different congealing points of their glycerides and by their partial saponification, I think it more than probable that this new acid will be found to be closely allied to oleic acid and its analogues ricinoleic and linoleic.

In conclusion, I have shown, first, what the conditions are which obtain in the separation of croton oil by alcohol into its vesicant and purgative parts. Secondly, the vesicating activity of the alcohol-soluble croton oil I have proved not to exist in the free acids and not to belong to any basic constituent, but to reside in the combined non-volatile fatty acids. These have been separated to a considerable extent, if not to complete isolation, and the probable position of the new acid in the fatty acid series I have indicated. The further elucidation and study of the new acid I reserve for a future communication.
—*Phar. Jour. and Trans.*, Dec. 8, 1883.

NAPHTHOL: ITS MEDICINAL USES AND VALUE.

In a paper under this title, read before the Philadelphia County Medical Society on October 17th., by Dr. John V. Shoemaker, Physician to the Philadelphia Hospital for Skin Diseases, that distinguished dermatologist calls attention to naphthol in a manner calculated to ensure for that drug a more extensive trial by the profession of the United States, than has yet been accorded it.

Naphthol is a derivation of naphthalene, a hydrocarbon found in large quantities in coal tar, belonging to the so-called aromatic group. It bears the same relation to naphthalin that phenol does to benzol, and cresol to toluol. It was first employed by Professor Kaposi as a substitute for tar in skin diseases, being considered by him as the essential curative ingredient of that substance, while being free from its objectionable features. The preparation employed in the cases which form the basis of Dr. Shoemaker's report was that made after the method of Dr. Justus Wolf, being free from odor and coming in beautiful crystalline scales. This preparation decomposes under the influence of heat when it again becomes odorous and pungent. The commercial naphthol contains impurities which unfit it for use in medicine. Naphthol thus properly purified is an extremely powerful antiseptic and disinfectant. One part added to 480 of urine kept the latter from decomposing for six months, while another sample of the same urine

to which naphthol was not added had a strong putrid odor at the end of eight days. The addition of the naphthol to this putrid sample divested it of all odor within twenty-eight hours.

Dr. Shoemaker's therapeutic experiments extended through some nine months and sufficed to convince him of the great value of naphthol in medicine.

He found it to fully sustain the claim that Kaposi had made for it in scabies, psoriasis and chromophytosis, as well as in some of the chronic forms of eczema, in which it not only allayed the itching attendant thereon, but lessened the infiltration as well. In wounds and indolent ulcers it is a most useful detergent and deodorant, removing the fetor and establishing healthy action of the parts. Aqueous solutions, containing half grain to the ounce, were used to great advantage as vaginal injections, especically in leucorrhœa and uterine carcinoma, as well as in gonorrhœal affections, both in male and female. In diphtheritic throat affections it made a most useful gargle, as well as to remove the fetor of catarrhal and other affections of the buccal cavity. Its greatest value, however, arose from its disinfectant action on the evacuations of fever patients and in rooms containing them, while by its absence of odor it did not tend to produce inconvenience either to patient or attendants. Combined with powdered talcum or starch, or both, and dusted into the shoes or stockings of those affected with fetid exhalations of the feet it acts most satisfactorily, and its effects are equally as good in the same affection involving the hands, axillary and inguinal regions. Combined with other ointments in the porportion of from one to ten grains to the ounce, it not alone preserves the unguent from decomposition, but excerciseis also an antiseptic action on the parts and the exudation therefrom. A slight admixture to an experimental sample of lard preserved the same in excellent condition throughout the hot summer months. In chronic psoriasis, particularly when there is great infiltration, a five to fifteen per cent. ointment was frequently attended with good results. It also proved very effective in squamous and fissured eczema, used in combination with lard or gelatin.

After his long and successful employment of naphthol Dr. Shoemaker was surprised to find that serious untoward effects had been reported from its use by foreign authors. With a view to further testing its toxic properties he first administered it to a rabbit internally in a saturated solution. But on discovering no injurious effect he selected another rabbit which he determined to poison with a view to observing

the *post-mortem* appearances. He accordingly gave it at first one-grain pills of naphthol every three hours, and subsequently increased the amount to two grains and again to four grains at the same intervals. But beyond increasing the animal's appetite no effects were apparent. Following these experiments two of his assistants took numerous and large doses (reaching as high as five grains twice a day) without other effect than a sensation of temporary warmth in the epigastric region after each dose and subsequent slight vertigo and buzzing of the ears, with other evidences of hyperæmia. The alvine evacuations were softened to a mushy consistence and changed to a clay color; in one instance diarrhœa occurred. The deduction from these experiments clearly is that in the case of the ill effects reported an impure preparation had been employed.

Dr. Shoemaker pronounces purified naphthol to be far superior to carbolic acid and the other antiseptics which have been in vogue, while it is almost absolutely odorless. It has the advantage also of being cheaper than carbolic acid, when the amount required to produce its effect is considered.—*Phar. Jour. and Trans.*, Dec. 1, page 430.—*Therap. Gazette*, Nov., 1883.

CONTRIBUTION TO THE PHARMACY OF THE POMEGRANATE.

BY LOUIS SIEBOLD.

Read before the British Pharmaceutical Conference.

The great value of the root-bark of *Punica Granatum* as a remedy for tapeworm is so well established as to need no comment. It is well known, however, that the administration of this drug often results in failure on account of the extremely nauseous astringent taste of its decoction and its consequent rejection by the stomach, a fact which renders it almost useless for ladies and children. The usual way of meeting similar objections in other cases, by substituting the active principles for the crude drug, does not seem to promise well in this instance, owing to the difficulties attending the isolation of these principles in a pure state and their proneness to decomposition (see C. Tanret's researches on pelletierine and the other alkaloids of the pomegranate, abstracted in the "Year-Book of Pharmacy," 1878, p. 43; 1879, p. 38; and 1880, p. 64.) The question then arises, whether it is possible to produce, by a comparatively simple process, a pharmaceu-

tical preparation of this bark, which, while possessing the full activity of the drug, is at the same time free from the nauseous taste and the unpleasant effects alluded to. Such a preparation, I believe I have succeeded in making. I do not wish to trouble the meeting with the various steps taken in working out the problem, nor with particulars of unsuccessful experiments in the direction indicated, but will at once lay before you the details of the process finally adopted.

Six ounces of the coarsely powered root-bark are digested three successive times with 48 fluidounces of water at 160° F., previously acidified with a few drops of acetic acid, each time for about twelve hours, during which the mixture should be frequently agitated and the temperature maintained at or near the point given. The strained infusions, measuring in all nearly 140 fluidounces, are united, and gradually mixed with solution of sugar of lead until no further precipitate is formed on testing filtered portions; the whole is then filtered, the slight excess of lead removed from the filtrate by a current of washed sulphuretted hydrogen, the mixture warmed for some time to expel the excess of the gas and again filtered, and the perfectly clear liquor evaporated on a water-bath to the consistence of a syrup, at a temperature not exceeding 140° F. Evaporation *in vacuo* would probably be better still; but this I have not tried. Finally the small quantity of residue left is mixed with syrup of orange peel sufficient to produce a draught of about 2 fluidounces. This draught represents a dose for an adult, and should be taken at once, first thing in the morning, the patient abstaining from food and keeping quiet for about four hours after the administration. A diet of meat and fish, without bread or farinaceous food of any kind, should be observed for the two days preceding the cure, and on the last day no food whatever should be taken after dinner. During this afternoon it is also advisable to clear the bowels by means of a mild purgative; if then the draught be taken at about two or three o'clock the following morning and sleep again resorted to after its administration, the patient will have done all he can to ensure success.

In eight out of nine cases in which the efficacy of this preparation was tested, the entire tapeworm was expelled within five hours after the consumption of the draught, and in one case only success was not complete. The eight cases comprise three of *Tænia solium*, and five of *T. mediocannellata*. In one of the latter instances not the slightest care as regards diet was observed, and, contrary to all instructions, the

patient took a heavy supper the night before the administration of the draught, and yet the entire worm was expelled. In all the eight cases, various tapeworm remedies had been tried previously, decoction of pomegranate root-bark being also among those employed without success, the head of the worm remaining, although the decoction in the cases alluded to was retained by the patient. It would thus appear that the preparation I have described, in addition to being free from all objectionable taste, may also be superior to the decoction of the bark in point of activity, owing, probably, to the entire absence of astringent principles, the abundant presence of which in the decoction is not unlikely to counteract the effect of the anthelmintic constituents.

The preparation obtained as above has a pleasant fruity flavor and is readily borne by the stomach. The most fastidious patient would take it without the slightest difficulty. The value of such a preparation appears to me the greater from the fact that all tapeworm remedies of repute share the nauseous taste and sickening effects of the decoction of pomegranate bark.

While admitting that the cases in which this new preparation has thus far been put to the test are yet not great in number, I think I am justified by the results in inviting the best attention of medical practitioners on the one hand, and of pharmacists on the other, to this subject. Those who are fully acquainted with the numerous failures in the treatment of cases of tapeworm by even the most renowned remedies, must long since have felt the want of a preparation combining efficacy with freedom from all unpleasant taste.—*Phar. Jour. Trans.*, November 17, 1883.

NOTES AND SUGGESTIONS UPON TINCTURE OF NUX VOMICA.

BY WYNDHAM R. DUNSTAN,

Assistant Lecturer in Chemistry and Physics to the Pharmaceutical Society and Demonstrator of Practical Chemistry in the School of Pharmacy;
and

F. W. SHORT,

Assistant Demonstrator of Practical Chemistry in the School of Pharmacy.

In a former paper we have shown by analysis that commercial tinctures of nux vomica vary considerably in alkaloidal strength (see "*Amer. Jour. Phar.*," 1883, p. 579). This difference is no doubt in the first instance due to a variation in the amount of alkaloid contained in the seeds of *Strychnos nux vomica* now in commerce, the existence of

which we have already proved in a previous communication to this Society (see "*Amer. Pharm. Jour.*," pp. 268 and 467). There are, however, other possible causes which might contribute to the inconsistent result. Foremost among these is the possibility of alcohol containing more water than rectified spirit having been employed in the manufacture of the tincture; this conjecture might appear to be supported by a relation which is noticed in the table of analyses published in our previous paper upon this subject. For it is here observed that in certain cases high specific gravity is associated with a large percentage of alkaloid. The important assumption underlying this conjecture is that a dilute alcohol extracts more alkaloid than a stronger alcohol; but, as far as we can discover, this has never been experimentally substantiated. Nevertheless, various suggestions based upon this assumption have been made for the employment of a weaker alcohol than rectified spirit for the preparation of the tincture, and some of these suggestions have been adopted in foreign pharmacopœias.

In order to determine by direct experiment the extractive power of alcohol of different strengths the following experiments were made. Five gram quantities of nux vomica in impalpable powder were macerated for three days with 50 cubic centimetres of alcohol containing different proportions of water, the mixtures being frequently agitated. Maceration was adopted, because percolation with alcohol containing more water than proof spirit is rendered practically impossible owing to swelling of the seeds and consequent clogging of the percolator, occasioned by the action of the water upon the mucilaginous constituents, and it was deemed important that the experiments should be strictly comparative. And further, had ordinary percolation been adopted and a larger amount of alkaloid been found to be extracted by the weaker spirit, there would be the alternative that this was due, not to the greater solubility of the alkaloidal salts in the weaker spirit, but to the longer time during which the seeds were in contact with this spirit, for with nux vomica the rate of percolation is inversely as the quantity of water present. After maceration forty cubic centimetres of the tincture were filtered off and the amount of total alkaloid determined by a process which has been described in general outline in our former paper upon tincture of nux vomica.

In detail the process is as follows: The quantity of tincture to be estimated, usually 50 grams, is evaporated almost to dryness upon the water-bath in a beaker; to this residue 25 cc. of chloroform are added,

but inasmuch as the residue will not dissolve in chloroform alone 15 cc. of dilute sulphuric acid (5 per cent.) are added, and the mixture is poured, after gently warming, into a separating funnel, well shaken, and the chloroform run off; the latter is extracted with a little more acid if necessary. The acid liquid, which contains the alkaloid, is rendered alkaline with ammonium hydrate and agitated with 15 cc. of chloroform, which is separated and filtered if necessary. The alkaline liquid is again shaken with chloroform and the latter run off. The mixed chloroformic solutions, which should be perfectly clear, are evaporated to dryness upon the water-bath, and after exposure for one hour at this temperature the residue of total alkaloid is weighed.

In many cases the residue from the evaporation of the tincture may be directly dissolved in dilute sulphuric acid, the liquid rendered alkaline with ammonium hydrate and the alkaloid extracted with chloroform. In certain cases, however, the alkaloid obtained in this way contains a trace of coloring matter, but a perfectly pure residue is obtained by the method described at length above.

The following table shows the results of the experiments:

TABLE I.

Proportion of rectified spirit to water (by volume).	Quantity of total alkaloid in 40 ccs of tincture.	Percentage of total alkaloid extracted from the nux vomica.
100 : 0 (rectified spirit)	0.078	1.95
100 : 25	0.088	2.20
100 : 33	0.088	2.20
100 : 50	0.089	2.22
100 : 60 (proof spirit)	0.086	2.15
100 : 100	0.074	1.85

The marcs from these tinctures were found in all cases to be distinctly bitter, and hence in no case had the exhaustion been complete. The above results show that water mixed with rectified spirit in any proportion up to and including proof spirit extracts more alkaloid than rectified spirit alone; but when the water rises above the proportion contained in proof spirit the extractive power for alkaloid again diminishes. The obvious conclusion to be drawn from these experi-

ments is that proof spirit should be substituted for rectified spirit in the preparation of tincture of nux vomica. But there is one strong reason for suggesting the use of 100 volumes of rectified spirit mixed with 25 volumes of water. For although the extractive power of these two spirits may be said to be the same, the use of the stronger spirit has this advantage over proof spirit, that it percolates very much more freely, while, owing to the larger proportion of water in the proof spirit, the percolation occupies a much longer time and the percolator is very apt to clog.

Rother (see "*Amer. Jour. Pharm.*," lv., 1; "*Pharm. Jour.*" [3], xiii., 643) has proposed the use of sodium chloride in the preparation of tincture of nux vomica, claiming that more complete exhaustion is by this means obtained; but this statement is not supported by any alkaloidal determinations. We have therefore experimentally studied the influence of sodium chloride upon the extraction of nux vomica by alcohol. Rother recommends the use of spirit the strength of which is represented by equal volumes of rectified spirit and water; but in view of the results obtained above, we have employed 100 volumes of rectified spirit to 25 volumes of water.

Five grams of nux vomica were macerated for three days with 50 cc. of spirit containing 100 volumes of rectified spirit and 25 volumes of water, in which was dissolved 0.7 gram of sodium chloride. Three experiments were made. In the first experiment the maceration was continued for two days; in the second and third experiments for three days. The results are recorded in Table II.

TABLE II.

Proportion of rectified spirit to water. (By volume.)	Percentage of Na Cl dissolved in spirit.	Amount of total alkaloid in 40 cc. of tincture.	Percentage of alkaloid extracted from the nux vomica.
100 : 25	1.5	0.087	2.18
100 : 25	1.5	0.102	2.55
100 : 25	1.5	0.100	2.50

As maceration is but an imperfect process of exhaustion, two experiments were made by percolation, spirit of the above strength being employed in one experiment and the same spirit containing 1.5 per cent. of sodium chloride in the other. Five grams of the finely powdered seeds being percolated with 50 cubic centimeters of the spirit. The results are shown in Table III.

TABLE III.

Proportion of rectified spirit to water. (By volume.)	Percentage of Na Cl dissolved in spirit.	Amount of total alkaloid in 50 cc. of tincture.	Percentage of alkaloid extracted from nux vomica.
100 : 25	0·	0·125	2·5
100 : 25	1·5	0·130	2·6

In the first experiment the marc was slightly bitter, but in the second, where sodium chloride was used, the marc was entirely free from bitterness, indicating complete exhaustion. It will be seen from these experiments that a spirit made by the addition of 25 volumes of water to 100 volumes of rectified spirit extracts nearly the whole of the alkaloid from nux vomica when used in the proportion of 1 of nux vomica to 10 of the spirit. When sodium chloride to the extent of 1·5 per cent is dissolved in spirit of the above strength the whole of the alkaloid is withdrawn from the seeds, the sodium chloride no doubt acting, not chemically as Rother maintains, but physically, by softening and dissolving the albuminous matter of the seeds, as it is known to do in other cases. As the ultimate gain effected by the use of sodium chloride is but small, it becomes a question for consideration whether it should be adopted in practice.

It has frequently been suggested that tincture of nux vomica should be prepared by dissolving a definite quantity of extract of nux vomica in alcohol. Apart from any practical difficulties that may stand in the way of this suggestion, it is based upon the supposition that extract of nux vomica is a product of definite alkaloidal strength, and therefore that when a tincture contains a known quantity of the extract it may be considered as uniform in action and composition. This supposition, as we shall subsequently prove, is entirely erroneous, extract of nux vomica being in reality very variable in alkaloidal strength, just as the tincture is, when prepared in the ordinary way. The new edition of the United States Pharmacopœia contains a process for making tincture of nux vomica constant in the amount of extract which it contains. But, it appeared to us that, having an extract known to contain a definite quantity of alkaloid to work with, there would be a distinct advantage other things being equal, in preparing the tincture from such an extract. We therefore made experiments to determine whether by any simple means an extract of nux vomica could be prepared that

would wholly dissolve in alcohol, forming a solution that would not deposit upon keeping.

Experiment 1.—An extract of nux vomica was prepared with rectified spirit and evaporated upon the water-bath until it had the consistence of a soft extract. Ten grains of this were dissolved with the aid of a gentle heat in one ounce of rectified spirit, by which means a perfectly clear solution was obtained, but in twenty-four hours this had deposited a white sediment.

Experiment 2.—An extract was prepared in the same way as in experiment 1, but ten grains were dissolved in one ounce of a mixture of two volumes of rectified spirit and one volume of water with the aid of a gentle heat. A large quantity of oily matter refused to dissolve and the tincture soon deposited a copious yellow sediment.

Experiment 3.—The same extract was used as in the former experiments, but the solution of ten grains was attempted with one ounce of proof spirit. Some oil remained insoluble and the tincture deposited abundant yellow sediment.

Experiment 4.—The extract was prepared with rectified spirit, evaporated upon the water-bath, and exposed for eight hours. Ten grains of this extract dissolved readily in one ounce of rectified spirit, but the tincture deposited a small quantity of brown sediment.

Experiment 5.—The extract in this case was prepared with proof spirit and evaporated to a soft consistence. Ten grains of this were dissolved in one ounce of proof spirit, yielding a nearly clear tincture, which deposited very slightly after twenty-four hours.

The above experiments indicate that there is no very ready means of obtaining a perfectly stable tincture of nux vomica from the solution of the extract in alcohol, although experiments 4 and 5 might possibly be modified to yield good results. However, we are now engaged in elaborating a simple and direct method of preparing tincture of nux vomica of definite strength upon different lines, and hope to bring our results before this Society at a future meeting.

Our thanks are due to Professor Attfield, F.R.S., for having permitted this investigation to be carried out in the laboratories of the Pharmaceutical Society, and to the British Pharmaceutical Conference for having aided the work by a grant from its Research Fund.—*Phar. Jour. Trans.*, Dec. 1883.

ON EXTRACT OF NUX VOMICA.

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The only analysis, as far as we know, that has been published of extract of nux vomica is that made by Dragendorff,¹ who records that he found in one sample of the extract 7.3 per cent. of total alkaloid, and in another 8.5 per cent. Our first experiments upon this subject were directed to the discovery of a simple and accurate method for the estimation of the total alkaloid in the extract. In a previous paper ("Phar. Jour." [3], xiv, 292) we described a process of this kind for the determination of the total alkaloid in tincture of nux vomica, which consisted in evaporating the tincture to dryness, and then dissolving the residue in a mixture of chloroform and dilute sulphuric acid. We first tried a similar process in the case of the extract, but it was found that although the commercial extract was wholly dissolved by the above mixture, the alkaloid subsequently extracted by chloroform, after the addition of ammonium hydrate, was slightly impure.

We therefore made further experiments, which led to the adoption of the following process: About one gram of the extract is dissolved in a strong solution of sodium carbonate with the aid of a gentle heat. This solution is extracted with two consecutive 15 cc. of chloroform. The mixed chloroformic solutions are extracted with two consecutive 15 cc. of dilute sulphuric acid (5 per cent.), and from the mixed acid solutions, which should be filtered if necessary, the total alkaloid is extracted after the addition of ammonium hydrate by agitation with chloroform, two separate quantities of 15 cc. being generally sufficient. The clear chloroformic solutions are evaporated to dryness upon the water-bath, and the residue of total alkaloid weighed after exposure for one hour. The alkaloidal residue thus obtained was shown to be pure by applying the ammonia-tannin process, which we have fully described in a former paper. The following is a typical result: (a)

¹ "Die Chemische Werthbestimmung," p. 72.

amount of alkaloid originally found; (β) amount of pure alkaloid obtained by ammonia-tannin process.

$$\alpha-0.164.$$

$$\beta-0.161.$$

Twelve commercial specimens of extract of nux vomica were now analyzed, the total alkaloid being estimated in the manner above described and the strychnine by a method of precipitation as ferrocyanide, which we have described at length elsewhere ("Pharm. Journ." [3], xiv, 290); the brucine was estimated by difference. In addition the quantity of "moisture" indicated by the loss at 100°C. has in all cases been determined. The results are recorded in the following table:

Analyses of Extracts of Nux Vomica.

No.	Percentage of moisture.	Percentage of total alkaloid.	Percentage of strychnine.	Percentage of brucine.
1	16.7	15.15	6.63	8.52
2	19.7	15.64	7.44	8.20
3	15.5	10.32	4.19	6.13
4	15.7	15.16	7.08	8.08
5	16.0	12.49	5.53	6.96
6	13.9	12.53	5.17	7.36
7	13.8	12.25	4.87	7.38
8	17.8	17.54	7.52	10.02
9	13.6	15.78	6.41	9.37
10	16.0	15.94	6.84	9.10
11	17.3	16.24	5.81	10.43
12	15.9	17.12	8.58	8.54

It will be seen that, just as in the seeds and tincture, so in the commercial extracts of nux vomica, our analyses indicate a serious want of uniformity in the alkaloidal content. This variation in the extracts might arise at least from two causes: (1) the difference in alkaloidal content among the seeds of commerce; (2) the practice, which might appear from some observations subsequently recorded to be far from uncommon, of removing the oil which separates during the manufacture of the extract.

When an alcoholic tincture of nux vomica is evaporated a comparatively large quantity of oil separates as the evaporation proceeds, for this oil, while soluble in alcohol, is insoluble in water. Now, an examination of the oil separated in this way has shown us that it contains alkaloid, both strychnine and brucine, and hence its removal from the extract, in any case illegitimate, is accompanied by abstraction of alkaloid and consequent diminution in the total content. The presence of oil in an extract may easily be detected by warming with water or dilute alcohol, and upon cooling the oil will separate and float upon the surface of the liquid. Some of the commercial extracts, the analysis of which has been given above, failed to yield more than a mere trace of oil when tested in this way. This may be due either to the abstraction of oil during manufacture or to the use of a very dilute spirit in the preparation of the extract. We have found that an extract prepared in the latter way contains little oil. If the absence of the oil is due to this second cause, and a spirit about the strength of proof spirit has been employed in the manufacture of the extract, from results published in our foregoing paper more alkaloid should be extracted in this way. In the case of one of the extracts examined, namely, that which is richest in total alkaloid, this would seem to be the case, for we found that this extract contained no oil; although this result might have been brought about by the actual removal of the oil during manufacture, the quantity of oil removed being large in proportion to the small quantity of alkaloid which it contains. The actual method of manufacture being unknown to us, the truth of these conjectures must necessarily be uncertain; but, be the cause what it may, we have shown beyond doubt that there is a serious want of uniformity both in the extracts and in the method of their preparation. In a future communication we shall hope to bring forward a simple and direct method for the preparation of an extract of nux vomica which shall be constant in alkaloidal strength.

We are indebted to Professor Attfield, F.R.S., for allowing the work connected with this investigation to be carried on in the laboratories of the Pharmaceutical Society, and have also to acknowledge a grant from the Research Fund of the British Pharmaceutical Conference in its aid.—*Phar. Jour. and Trans.*, Dec. 8, 1883.

ACONITINE FOR INTERNAL ADMINISTRATION.

BY T. B. GROVES.

Read before the British Pharmaceutical Conference.

From a perusal of an article "Preparations of Aconite," in No. 5, vol. i., of Dr. Squibb's *Ephemeris*, it would appear that aconite plays a more important part in medication on the other side of the Atlantic than it does in this country. Here the admitted uncertainty of action both in degree and kind of the official preparations of the drug seems to have had the effect of dismissing both drug and preparation from the medical armory: there, on the contrary, this feeling serves but to stimulate research with the view of providing for medical practitioners a trustworthy preparation of a drug of admittedly high value. Pharmacists cannot but feel greatly indebted to Dr. Squibb for his able article on the subject, although his conclusions may not meet with universal acceptance. In fact, it seems to me that to decide, after all the labor that has been expended on the chemistry of the aconite alkaloids by Wright, Duquesnel, and others, on recommending for internal use a fluid extract of a root that varies so greatly in activity, is a distinct retrogression in pharmacy tending to render useless a vast amount of original research conducted with unusual care and completeness. It is true that Dr. Squibb has indicated a method of estimating by the sense of taste the quality of the root, but such a method, crude in extreme as it must be in any case, would be unable to distinguish between roots differing widely in their chemistry and physiology, like *A. Napellus* and *A. ferox*. In fact, the latter, owing to the less amount of acrid resin it contains, would give a less marked result than its less potent congener. It is not pretended that the subject has been exhausted. New varieties of root have from time to time made their appearance in the market, and though the chemist has essayed to perform his part in their examination, he has not been adequately seconded by the experimental physiologist. The legal difficulties in the path of inquiry in this direction may well account for the apparent and probably only apparent lack of interest among the medical profession in a class of remedies so potent for good or evil as the various alkaloids of the genus *Aconitum*.

Practically we may, I think, limit our attention to one species only of the toxic aconites. *A. Napellus* is that which has, I believe, been

invariably ordered in the manufacture of what may be termed crude aconite preparations for internal use, and it is to it that the text-books refer when treating of the physiological properties of aconite. Its alkaloid, nap-aconitine, has been examined and described by several experimenters, so that its identification when in a pure crystalline condition is comparatively easy. Moreover, its precise physiological action has been studied by Dr. Fraser, of Edinburgh, who compared its action with that of fer-aconitine (the so-called pseudaconitine of Von Schroff) who reported thereon to the British Association at the Bradford meeting in 1873. His results, which are given in short abstract in the Annual Report, point to the necessity of discriminating between the two alkaloids when used for internal administration. But can they be with certainty discriminated? Undoubtedly, and it is the more necessary to take precautions in this direction, owing to the fact which Wright has pointed out that *Aconitum Napellus* yields both nap-aconitine and fer-aconitine, the later in very small proportion it is true but still enough to modify in a sensible degree the action of its companion alkaloid. That the more powerful *A. ferox* has frequently (probably as often as procurable) been employed for the extraction of commercial aconitine is unquestionable. The element of uncertainty thus introduced has perhaps had much to do with the neglect with which English practitioners have treated aconitine as an internal remedy; a neglect which is seen to be fully justified when it can be shown that of the commercial aconitines so-called many are wholly amorphous and therefore indefinite in character, whilst others are not only so, but are also contaminated with aconite alkaloids without toxic properties, and of little physiological activity of any kind.

Mr. Cleaver has pointed out the source of one such possible contaminant in *A. paniculatum*, which he states yields an inert alkaloid identical with that provisionally named pieraconitine, which I extracted in quantity from a batch of so-called *A. Napellus*. I at first supposed it to be identical with atisine, the alkaloid of *A. heterophyllum*, but I was assured by Dr. Broughton, who saw my specimens, that such was not the case, an opinion afterwards borne out by the results of combustions carried out in the laboratory of Dr. Wright.

I would recommend to anyone setting about the preparation of nap-aconitine for internal administration to be very careful in the selection of his roots. If possible, they should be grown in this country, with guarantee from the grower that they are the produce of *A. Napellus*.

Mr. Holmes will soon, I hope, be able to tell us more about the numerous varieties of this plant and their relative degrees of toxicity.

To him we also hopefully look for showing us how to recognize them by optical means, microscopic or otherwise, as well as how to distinguish between the dried roots of *A. Napellus* and *A. paniculatum*.

Having obtained by following Stas' general method of extraction the crude alkaloids of presumably true roots, the aconitine before it can be safely used for internal exhibition must be separated in a crystalline condition. This is not difficult, but it is wasteful, if such a term can be permitted in this connection. Ordinary skill only is required, helped by extraordinary patience. As I pointed out so long ago as 1866, the nitrate is the best of its salts to crystallize, a fact I had demonstrated two years previously. I have never failed in producing it in quantity averaging, perhaps, one third of the total yield of alkaloid. From the nitrate the pure alkaloid or any of its salts can be made without difficulty.

It fortunately happens that the nitrate of fer-aconitine is crystallizable only from a strongly acid solution. It is therefore necessarily excluded from the crop of crystals obtained from a neutral or nearly neutral liquid.

There remains the possible admixture of pieraconitine, the nitrate of which crystallizes in forms so like those of nap-aconitine that by an ordinary observer they would not be distinguishable. Its bitterness is its most patent distinction. The poisonous aconitines are much less bitter. Moreover, its comparative solubility in dilute ammonia is characteristic; so that a nitrate of aconitine that yielded on precipitation with dilute ammonia a proportion of alkaloid much less than that due to its centesimal composition would deservedly be suspected. However, the best test of all would be the physiological applied to each batch of alkaloid by a competent experimenter, and a series of preparations so guaranteed produced by a house of known reputation, I am confident that in the course of a short time they would be accepted by the medical profession as a valuable addition to the list of heroic remedies.—*Phar. Jour. and Trans.*, November 17, 1883, p. 397.

Sulpho-Carbolate of Sodium, in thirty-grain doses given after meals, is recommended in flatulent dyspepsia; also in ten-grain doses for nausea and vomiting, particularly in pregnancy.—*Louisville Med. News.*

NOTES ON CINCHONA ALKALOIDS.

BY C. H. WOOD AND E. L. BARRET.

In an abstract published in "*Amer. Jour. Phar.*," 1882, p. 75, the authors state that the crystals obtained from an ethereal extract of cuprea bark were composed of equal quantities of quinine and quinidine. They have since then investigated this subject more closely, and publish the results, etc., in the present paper. In the first case equal quantities of quinine and quinidine sulphates were dissolved separately in acidulated water, the solution shaken with ether, excess of soda added, and the whole agitated; as soon as the precipitates had dissolved in the ether, the ethereal solutions were decanted off and mixed. The crystals deposited from this mixed solution yielded, on analysis, numbers approximating to the composition 1 mol. quinine + 1 mol. quinidine + $2\frac{1}{2}\text{H}_2\text{O}$. In another experiment equal weights of the alkaloids were dissolved together in 50 per cent. spirit. The crystals obtained from this solution, after 48 hours' exposure over sulphuric acid, were similar in constitution to those described above. Whilst in a third experiment equal weights of the two sulphates were dissolved, etc., as in the first experiment, but the alkaloids were taken up with warm benzene. This time the crystals, even after three days' exposure, were found to contain 1 mol. quinine + 1 mol. quinidine + $2\text{H}_2\text{O}$ + C_6H_6 . From these facts the authors infer that the crystals always contain water, and therefore this compound is a hydrate of the two alkaloids.

When anhydrous, a mixture of quinine and quinidine has a lower melting point than either of the constituent alkaloids. Some of the anhydrous double body dissolved in dry benzene had deposited only a very few crystals, after remaining corked up ten days, but on removing the cork and exposing the contents of the flask to the air plenty of crystals soon formed, and in two days the solution was half filled with them. Quinine, prepared from the sulphate, when dissolved in warm benzene, forms rhomboidal crystals of the composition 2 mols. quinine + $2\text{H}_2\text{O}$ + C_6H_6 . They lose the benzene slowly; a sample after being kept for some time had lost all odor of benzene, but gave evidence of the presence of the hydrocarbon when treated with an acid. The authors remark on the analogy these crystals bear to those of the quinine and quinidine compound when crystallized from the same

menstruum. When anhydrous quinine is dissolved in dry benzene, it crystallizes out in needles containing a large quantity of benzene, which is gradually given off until only 1 mol. benzene is retained. Cinchonidine crystallizes from benzene without water, but with 1 mol. benzene, with which it readily parts. The benzene employed in these experiments was carefully purified. The authors recommended the following test for the purity of quinine: 0.7 gram of the quinine sulphate to be tested is dissolved in 20 drops of hydrochloric acid and 7 cc. of water; 7 cc. of benzene are added, and the whole warmed, and then shaken up with $3\frac{1}{2}$ cc. of dilute ammonia. The benzene layer is separated, the quinine hydrate allowed to crystallize out and filtered off; the separation of feathery crystals then indicates the presence of cinchonidine. These crystals contain a large quantity of quinine. Less than 1 per cent. of cinchonidine can be recognized in this way. The crystals must be sought for within the liquid, not on the surface. The quantities and method of procedure given above must be strictly followed in order to ensure success. Absolutely pure benzene is not necessary for this test: the benzene should, however, crystallize when placed in a freezing mixture.—*Jour. Chem. Soc.*, Nov., 1883, from *Chem. News* [48], 4.

THEOBROMINE.

BY E. SCHMIDT AND H. PRESSLER.

To prepare theobromine, the authors mix cacao which has been freed from oil by pressure, with half its weight of calcium hydroxide, and boil repeatedly with 80 per cent. alcohol. After recrystallizing the residue obtained from the evaporation of the alcohol, the theobromine forms a white crystalline powder. It is anhydrous, and sublimes at about 290° without melting. Its salts are obtained by dissolving the base in concentrated acids, and resemble those of caffeine in their instability, being decomposed by contact with water or alcohol. The *hydrobromide*, $C_7H_8N_4O_2 \cdot HBr + H_2O$, forms colorless transparent platy crystals, which lose their water at 100° together with a part of the hydrobromic acid. The *hydrochloride*, $C_7H_8N_4O_2 \cdot HCl + H_2O$, crystallizes in colorless rosette-like groups of needles which lose both water and hydrochloric acid at 100° . The *platinochloride* $(C_7H_8N_4O_2)_2, H_2PtCl_6 + 4H_2O$, has been described by Glasson. According to the

authors, it sometimes contains $4\text{H}_2\text{O}$ and sometimes $5\text{H}_2\text{O}$. The *aurochloride* $\text{C}_7\text{H}_8\text{N}_4\text{O}_2 \cdot \text{HAuCl}_4$, forms yellow tufts of needles. The *sulphate* has been obtained in small colorless crystals, but of varying composition. The *nitrate*, $\text{C}_7\text{H}_8\text{N}_4\text{O}_2 \cdot \text{HNO}_3$, has been described by Glasson. The *acetate*, $\text{C}_7\text{H}_8\text{N}_4\text{O}_2 \cdot \text{C}_2\text{H}_4\text{O}_2$, forms a white voluminous precipitate, which gradually loses its acid by exposure to the air. In its behavior to methyl iodide, theobromine differs markedly from caffeine, for on heating the mixture either alone or in solution in alcohol or in chloroform, no combination of the theobromine with the methyl iodide takes place, whilst if a mixture of theobromine, alcoholic solution of potash, and methyl iodide in equivalent quantities is heated at 100° in sealed tubes, caffeine is produced, identical with the natural bases: $\text{C}_7\text{H}_8\text{N}_4\text{O}_2 + \text{KOH} + \text{MeI} = \text{C}_7\text{H}_7\text{MeN}_4\text{O}_2 + \text{KI} + \text{H}_2\text{O}$. On heating theobromine with hydrochloric acid at $240\text{--}250^\circ$, it suffers decomposition similar to that of caffeine, yielding ammonia, methylamine, sarcosine, carbonic anhydride and formic acid. The same products are also formed on boiling theobromine with solution of barium hydroxide, and attempts to obtain an intermediate product, *theobromidine* (corresponding with caffeidine) have as yet been unsuccessful. The bromine derivative, $\text{C}_7\text{H}_7\text{BrN}_4\text{O}_2$, obtained by the direct action of bromine, agrees with the compound described by Fischer. When theobromine is boiled with five parts of concentrated nitric acid in an upright retort until the greater part of the liquid has been volatilized, and the residue then evaporated on a water-bath, amalic acid is obtained. On boiling the latter with concentrated nitric acid a further decomposition takes place, with evolution of carbonic anhydride and formation of methylparabanic acid and methylamine. Maly and Hinteregger (1881,) have shown that, besides these products, ammonia is also produced when the oxidation is effected by means of chromic mixture. Caffeine is decomposed by nitric acid in the same way as theobromine, dimethylparabanic acid, methylamine, and carbonic anhydride being formed, and in this case also no ammonia.—*Jour. Chem. Soc.*, Sept. 1883; *Annalen* 217, p. 287.

Napelline, an amorphous alkaloid obtained from aconite root, has been successfully used by Laborde to relieve neuralgia pains, and as a substitute for morphine in a case of the morphine habit. It was given hypodermically in doses of from one to four centigrams in the twenty-four hours.—*Journ. de Therapeut; Louisville Med. News.*

ACTION OF HYDROCHLORIC ACID ON CAFFEINE.

BY E. SCHMIDT.

It was thought possible that theobromine might be formed by this reaction with elimination of a methyl-group. No reaction, however, takes place below about 240° , the caffeine then decomposing, with formation of carbonic anhydride, ammonium chloride, methylamine hydrochloride, sarcosine hydrochloride, and traces of formic acid, $C_8H_{10}N_4O_2 + 6H_2O = 2CO_2 + 2MeNH_2 + NH_3 + CH_2O_2 + C_3H_7NO_2$. The reaction is effected in sealed tubes, the temperature being maintained at $240-250^{\circ}$ for 6—12 hours; above 260° the product becomes partially carbonized. The caffeine employed was the pure product obtained from tea. The methylamine hydrochloride is separated and purified by means of its platinohydrochloride, which crystallizes partly in lustrous yellow plates and partly in orange-red rosette-like groups. The sarcosine was identified by means of its copper salt $(C_3H_6NO_2)_2Cu, 2H_2O$, sarcosine obtained by the action of barium hydroxide on caffeine yielding a perfectly similar salt. These results show that caffeine yields the same products by the action either of hydrochloric acid or of barium hydroxide, except that in the former case the intermediate product, caffeineine, is not produced. Theobromine is decomposed by hydrochloric acid, with formation of the same products as in the case of caffeine, but the proportion of ammonia to methylamine is in this case two molecules of the former to one of the latter, showing that the additional methyl-group in the caffeine must be united with a nitrogen atom. The fact that only one of the four nitrogen atoms in caffeine can be eliminated as ammonia is in accordance with the formula given by Fischer (*Annalen*, 215, 314), and Medicus (*ibid.*, 175, 250), but is not explained by Strecker's formula (*ibid.*, 118, 171).

The author has also very carefully compared artificial caffeine as prepared by Strecker (*loc. cit.*) with natural caffeine obtained from tea. His results confirm those previously obtained by Strecker, a comparison of the following salts proving that artificial and natural caffeine are identical. The *hydrochloride*, $C_8H_{10}N_4O_2, HCl, 2H_2O$, forms colorless monoclinic crystals, which give off hydrochloric acid and water by exposure to air, leaving pure caffeine, the same change taking place rapidly at 100° , or by the action of water or alcohol. The *platinochloride*, $(C_8H_{10}N_4O_2)_2, H_2PtCl_6$, crystallizes in small rosette-like groups

of needles, and contains variable amounts of water. *Caff ine aurochloride*, $C_8H_{10}N_4O_2$, $HAuCl_4 \cdot 2H_2O$, forms lustrous gold-colored plates. *Caff ine methiodide*, $C_8H_{10}N_4O_2$, MeI , H_2O , is formed when caff ine is heated for some hours at 130° with an excess of methyl iodide in sealed tubes, and may be purified by washing with cold alcohol and crystallizing from water, in which it is moderately soluble, although but sparingly so in alcohol, and almost insoluble in ether.—*Jour. Chem. Soc.*, Sept. 1883; *Annalen* 217, p. 270.

THERMOMETRIC MEASUREMENTS.

By J. M. CRAFTS.

The author remarks at the outset that the progress made in the purification and preparation of chemical substances has not been accompanied by any appreciable improvement in thermometric measurements. In these communications the author gives an account of a series of experiments on the commonly employed methods of fusion and ebullition, with a view of facilitating the construction of thermometers, of examining their behavior, and of rendering the method of observation precise.

In the thermometers from the best sources the author observed residual errors of 0.015 — 0.04 degree, and when the scale is divided into tenths of a degree, in ordinary thermometers differences of length of 0.1 — 0.5 degree in contiguous sections of 25 degrees. As these variations rarely compensate one another, it is not rare to find thermometers which require corrections amounting to several fractions of a degree.

In determining the value of a degree from the points 0° and 100° , it is most important to follow an invariable order in the observation of these points. After the point 100° has been fixed, the zero point must be determined by quickly cooling and placing the thermometer in pounded ice, or preferably snow, which has remained for some time in contact with distilled water. But even after adopting all the necessary precautions, the value of a degree may vary owing to the displacement of the zero point, which causes a change in various proportions of all the constants. In the original paper examples are given to show that the elevation of zero of 1.24 to 2.6° may cause an increase in the interval 0 — 100° of 0.04 to 0.9 degree. On the other hand, a

depression of the zero point may be effected by heating a thermometer at various temperatures for a prolonged time, and then leaving it to cool in the air, and these depressions will necessarily increase all the constants of the thermometer when referred to the zero point. After such a depression has been effected, the thermometer, slowly at ordinary temperatures, but more quickly when warmed slightly, tends to revert to its original readings.

A considerable elevation of the zero point, 10° to 26° , is produced by heating the thermometer for a week at 355° , which is caused by the expansion of the glass bulb after it has been blown out and then suddenly cooled.

The elevation of zero in a thermometer maintained at ordinary temperatures diminishes gradually and ceases to be appreciable after five or ten years. Similarly variations produced by protracted heating tend towards constant limit; thus, for example, a thermometer may be heated for several days at 300° , or for several months at 100° without causing a variation in the effect produced by heating to 355° .

From the facts detailed above, it is necessary to heat a thermometer required for ordinary experiments for a week in boiling mercury, the whole of the stem being enclosed in the vessel; after this treatment, the points 0° and 100° will have a permanent value.

The author further remarks that thermometers with a limited range, from 200° to 300° for example, cannot be graduated with the same degree of precision, for the determination of the fixed points 0 and 100 becomes impossible, owing to the falling of the mercury within the reservoir. In order to fix definite points above 100° , the author suggests the use of naphthalene and benzophenone, substances which can be obtained in a state of purity; the former boils at 218° , and the latter at 306° under normal pressure; in a table in the original memoir, the boiling points of these two substances under various pressures are given.

In a thermometer which has been thoroughly deprived of air, the phenomenon of volatilization of mercury can be observed at 100° ; the column of mercury gradually descends, and after about 15 minutes the variation is about 0.01 — 0.02 degree. If the zero point is re-determined after each warming, no error is caused by the descent of the mercury. In all cases the mercury with which the thermometer is filled must not only be purified but boiled for a long time to rid the

instrument of bubbles of air which cling persistently to the sides of the bulb and stem.

The changes of barometric pressure may in ordinary cases be neglected, but it is necessary to take account of the differences of pressure dependent upon the horizontal or vertical position of the column of mercury in the stem of a long thermometer. But this factor cannot safely be neglected for second determination under reduced pressures, when the thermometer is immersed in the vapour : in these cases it is preferable to introduce a thermometer in a tube sealed at its lower extremity, and communicating directly with the atmosphere.

In conclusion, the author points out the errors in determination of boiling and melting points. In the former, errors frequently arise from a too hasty observation; to ensure accuracy the whole stem must be immersed in the vapour, and distillation must be carried on for at least ten minutes before the whole of the stem acquires the temperature of its environment.

To determine fusing points it is preferable to plunge the thermometer into the melting substances and to observe the changes of temperature during complete solidification : when the quantity of substance does not admit of this method of procedure, the usual process must be adopted.

In the memoirs, tables of corrections are given for converting readings of ordinary thermometers and those with limited scale, into readings of the hydrogen thermometer.—*Jour. Chem. Soc.*, Sept., 1883; *Bull. Soc. Chim.* [2] 39, p. 196.

EASILY OXIDISABLE CONSTITUENTS OF PLANTS.

BY J. REINKE.

It is a well-known fact that the juices of many plants become discolored on exposure to the air. So, too, sections of stems and roots of leaves and fleshy fruits which acquire a brown color on exposure. Little has been ascertained in regard to the physiology of these changes. They obviously depend upon the oxidation of certain constituents; this is seen, for instance, on exposing grated potatoes to the air, when the uppermost layer assumes a brown color, which by frequent turning over of the mass may be communicated throughout. The same is seen in the case of the expressed juice of the potato. Putrefaction or fermentation, and reducing agents, such as sulphurous or hydrosulphuric acid, decolorise these fluids. The juice of the white sugar-beet is even more sensitive, becoming on exposure to the

air immediately of a dirty wine-red color, then violet, brown and finally almost black. These facts indicate the presence in plants of easily oxidisable bodies, and inasmuch as the products of their oxidation do not occur within the uninjured cells, it follows that there is either no free oxygen in the latter, or that with these oxidisable substances other reducing substances are concomitant, hindering their oxidation, or again, that in the protoplasm oxidation affords other uncolored products. Upon which of these three factors the colorless state of the protoplasm and cell-juice of living plants depends is not yet decided.

In the study of oxidation processes in the living plant-cell, an important question presents itself, as to whether substances occur in the cell which at ordinary temperatures unite with atmospheric oxygen without the essential co-operation in this process of the living protoplasm. Difficult as the problem is, the isolation and determination of constitution of these easily oxidisable substances forms an indispensable preliminary step. It may be conjectured that they belong to the aromatic series. In this connection the numerous hydroxybenzene derivatives claim attention, of which many are known to be easily oxidisable. Pyrogallol in alkaline solutions greedily absorbs oxygen and becomes decomposed into carbonic anhydride, acetic acid, and a brown body of unknown nature. The dihydroxybenzenes (catechol, resorcinol, and quinol) are easily oxidisable bodies, and their methyl derivative orcinol is colored red by the air. As regards derivatives of the anthraquinone series, there is the change of indigo-white into indigo-blue, and the behavior of *Boletus luridus*, the colorless section of which becomes at once blue on exposure to the air. Lastly, there is a series of complex plant-constituents, undoubtedly benzene derivatives although their constitution has not yet been ascertained, which exhibit many analogies to the discoloration of plant juices. Of these brazillin may be named, the colorless aqueous solution of which becomes first yellow, then reddish-yellow in the air.

The author, in his endeavors to isolate the easily oxidisable constituents of the sugar-beet and potato to which the discoloration of their respective fluids is attributable, succeeded in the first instance in isolating from the beet-root a chromogen which on exposure to the air acquired a red color. This substance he has accordingly designated *Rhodogen*. The product of its oxidation he terms *beet-red*, and he notes certain remarkable analogies between the absorption-bands of this substance and of the coloring matter of *Anchusa tinctoria*, alkanet red, the spectrum of each showing three bands occupying identical positions. These investigations have therefore so far afforded proof of the existence in the colorless cells of the sugar-beet of an easily oxidisable colorless body, capable of isolation, which by itself, without the aid of the living plasma of the plant, can split up the oxygen molecule, forming a colored substance.

The isolation of the chromogen of the potato has not succeeded so satisfactorily. The presence of vanillin in the juice appeared to be shown by the strong odor of vanilla. Vanillin has been detected by Scheibler in raw beet-sugar. A substance resembling catechol, but not identical with it, was also separated. It would seem to be the same body discovered by Gorup-

Besanez in the leaves of *Ampelopsis hederacea*. It is undoubtedly an acid, and amongst the known aromatic acids most closely corresponds in its reactions with hydrocaffeic acid. In conclusion, the author suggests the hypothesis that these easily oxidisable bodies belong, in their physiological relations, to the retrogressive series, perhaps originating from the breaking up of albumin, or formed by the synthesis of the products of such decomposition, and that in these features they are allied to the process of respiration.—*Jour. Chem. Soc.*, Sept., 1883; *Zeitschr. Physiol. Chem.*, vi, 263.

VARIETIES.

USE OF NAPHTHALIN.—Dr. Lindenbaum has employed this remedy with success in a number of cases of frost-bite. The dressing is usually changed every seven to ten days. In some instances the patients complained for two or three hours after the application of severe sticking pains, caused probably by small crystals of naphthalin. The same remedy seems to be equally beneficial in burns.—*St. Petersburger Med. Wochenschrift*, June 2, 1883; *Med. Record*.

TRICHLOR-PHENOL has been experimented upon by Dr. Dianin, and described by him in the "*St. Petersburger Medicinische Wochenschrift*. It is prepared from carbolic acid and chloride of lime. ("British Medical Journal.") Its antiseptic properties are said to be more active than those of any other substance used in medicine (twenty-five times more so than carbolic acid), and a small quantity stops fermentation. It is also a deodorizer, while its own smell may be disguised by oil of lavender. Dissolved in water, it does not cause irritation. Its sodium and calcium salts also exhibit antiseptic properties; the former has no smell, and the latter is cheaper than phenol.—*Louisev. Med. News*, Sept. 15, 1883.

ARBUTIN.—Dr. H. Menche, in "*Centralblatt für. Klin. Med.*," finds that it acts in many cases as a valuable diuretic. Large doses may be taken without any ill effects. It passes in the urine partly in the form of hydrochinon, which is closely allied chemically to phenol. Urine containing hydrochinon becomes, by standing, of an olive-green color, just as happens in carboluria. Arbutin is of service in urethritis even of a specific nature. Brieger has employed a solution of hydrochinon as an injection in gonorrhœa, but the internal administration would seem to answer the same purpose. Arbutin is a glucoside, and occurs as fine white stable acicular crystals, soluble in water, of neutral reaction, odorless, and of slightly bitter taste. The best mode of administration is in the form of powder dissolved in a tablespoonful of water. Patients do not complain of its taste.—*Louisev. Med. News*.

THE ACTION OF QUEBRACHO.—A number of experiments, chiefly by Italian and Spanish physicians, which we find recorded in our foreign exchanges, satisfactorily show that quebracho and its alkaloids aspidosper-

mine and quebrachine act with positive effect in reducing the action of the heart and relieving many cases of dyspnoea. Mariani considers it the only agent known which exerts a specifically anti-dyspnoeic action by itself. He finds its exhibition very beneficial both in asthmatic and nervous dyspnoea and that which accompanies inflammatory pulmonic affections. Its action on the heart is decided enough to reduce its pulsations twenty in the minute.—*Med. and Surg. Reporter*, Dec. 8, 1883.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, December 18, 1883.

In the absence of the president, D. Parrish, Dr. A. W. Miller was called to the chair.

The minutes of the last meeting were read, and there being no corrections, were declared approved.

The chairman asked attention to a very beautiful set of chemical specimens presented by the Mallinckrodt Chemical Works, of St. Louis, Mo. This presentation was made at the suggestion of Dr. Miller to one of the firm, who was visiting the Eastern part of our country with a view of introducing their goods to the notice of the trade of this section.

The specimens were received, and ordered to be placed in the Cabinet, and the secretary directed to acknowledge their receipt, and to return the thanks of the College for the same.

The manufacturers express the hope that they may be made use of in illustrating the lectures before our classes. Two other sets of specimens were sent with these, one of which was donated to the University of Pennsylvania, the other to the Women's Medical College.

The report of the Commissioners of Public Education was acknowledged, and the librarian was instructed to preserve it in the Library.

A paper pure Chloride of Barium was read by Mr. A. E. Brown, a member of the present class. He states that there was found about 2.1 per cent. of alumina present.

Mr. Trimble said this did not prevent its use in precipitating sulphuric acid, but when barium determinations were to be made it was then a source of trouble. The paper was referred to the Publication Committee.

A paper upon Glycérine of Tar was read by the secretary, and also a short one upon Choleate or Cholenate of Sodium. The paper was referred to the Publication Committee.

Professor Trimble exhibited a specimen of Paraldehyd, which has been lately introduced for the same purpose as chloral hydrate. It is said to be less objectionable than Chloral as its use was not so likely to grow into a habit as was the case with other hypnotics. This statement, he said, must be taken with great allowance, as almost all the newly introduced preparations were generally much lauded, and subsequent use only gave them their true place.

Prof. Trimble stated that the Paraldehyd was made by treating aldehyd with strong sulphuric acid, refrigerating it, which caused it to crystallize; the crystals are to be separated, and as the temperature is raised the crys-

tals dissolve; the difficulty about preparing it is to obtain a pure aldehyd, while a considerable amount of it was offered as pure there was but little that was really so.

Dr. Miller stated that he had lately had occasion to test the solubility of Olibanum, and was surprised to find upon treating it with oil of turpentine that nearly fifty per cent. of insoluble matter was present, a good portion of which seemed to be of a calcareous nature.

There being no further business, the meeting adjourned.

T. S. WIEGAND, *Registrar.*

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

Botanical Microchemistry. An introduction to the study of vegetable histology. Prepared for the use of students, by V. A. Poulsen. Translated with the assistance of the author and considerably enlarged by Wm. Trelease, Professor in the University of Wisconsin. Boston: S. E. Cassino & Co., 1884, pp. 118.

Mr. Poulson's little work made its first appearance in Denmark in 1880, and in the following year a German translation of it was published. When we first began to consult it we found it of such great value, that we regretted that it was not available to a large number of the students in microscopy in this country. This want has now been supplied by Prof. Trelease, and we take great pleasure in recommending it to all microscopists. The treatise describes the different reagents used under the microscope and their application, also the most important mounting media and cements. The second part treats of the different vegetable substances, organized and unorganized, and the methods of recognizing them.

As compared with the German edition, the work has been considerably amplified by the author, and a number of valuable additions have been made by the editor and translator, who has performed his task very creditably. We would, however, suggest more consistency in the chemical nomenclature; there is no obvious reason why alongside of potassic hydrate, ferrocyanide and nitrate, we should have chlorate of potassium; or why for the chloride and acetate of iron, the ferric compounds should not be distinctly indicated by the name, the more so since in the text it is not stated whether the ferrous or ferric compounds are intended. The German designation "Chlorzinkjod" is descriptive for a solution of iodine in zinc chloride; but the same cannot be said of "chlor-iodide of zinc."

A Manual of Chemistry, physical and inorganic. By Henry Watts, B.A., F.R.S., editor of the Journal of the Chemical Society; author of "a Dictionary of Chemistry." Philadelphia: P. Blackiston, Son & Co., 1884.

The author states in the preface that the work is founded on the well-known "Manual of Chemistry" of the late Professor Fownes, a work which has been long and favorably known also in the United States, where it has been used as one of the most favorite text-books for students in chemistry.

Although the name of Fownes does not appear upon the title page, the present is merely a new edition of the original work, retaining all the excellencies of the latter and revised so as to represent the general principles

and most important facts accepted in the present state of chemical knowledge. Aside from what has been modified, rewritten or added, a rearrangement of the material has been deemed advisable, so that the book differs in some respects from its predecessors. These having been reviewed in former volumes of the "Journal," it is not deemed necessary to enter into its special features, which as stated before remain unaltered; nor can we attempt to point out the new matter added, which is in keeping with the original design of the work so well preserved by Mr. Watts in previous editions. We must content ourselves with stating the main features of the rearrangement of the subject-matter, which is nearly identical with that of Roscoe and Schorlemmer.

To the introductory part have been added brief sketches of the most important elementary bodies for the purpose of introducing here also the general laws of chemical combination, comprising nomenclature and notation, the laws of multiples and of equivalents, and equations.

The non-metallic elements are now considered in the following order: Beginning with hydrogen and with the four halogens, oxygen is next treated of, with the general conditions of combustion and the oxygen compounds of the preceding elements. Then follow sulphur, selenium, tellurium, nitrogen, phosphorus, arsenic, boron, silicon and carbon. The general laws of chemical combination are now considered more in detail, as they formerly were at the end of the non-metallic elements.

After a general characteristic of the metals and their compounds, these elements are then grouped together in the following manner: Alkali group consisting of potassium, sodium, lithium, cesium, rubidium, and ammonium; group of the alkaline earths, calcium, strontium and barium; magnesium group, containing also beryllium, zinc and cadmium; lead group with thallium; copper group with silver and mercury; yttrium group with cerium and eight other rare metals; aluminium group with indium and gallium; iron group with manganese, cobalt and nickel; chromium group with molybdenum, tungsten and uranium; tin group with titanium, zirconium and thorium; antimony group with vanadium, bismuth, tantalum and niobium; and platinum group comprising gold and the metals known as platinum-metals.

The appendix contains the tables of former editions. The text is illustrated with 150 well executed wood-cuts and spectral analysis is explained by means of a colored plate.

A Treatise on Pharmacy, designed as a Text-book for the Student and as a Guide for the Physician and Pharmacist, containing the Official and many Unofficial Formulas and numerous Examples of Extemporaneous Prescriptions. By Edward Parrish, late Professor in the Philadelphia College of Pharmacy, etc. Fifth edition, enlarged and thoroughly revised. By Thos. S. Wiegand, Graduate of the Philadelphia College of Pharmacy. With 256 illustrations. Philadelphia: Henry C. Lea's Son & Co., 1884. 8vo, pp. 1090.

This well-known work presents itself now based upon the recently revised new Pharmacopœia. Though the general character of the former editions has been preserved, several important modifications of the internal arrangement have been made, and we believe they will mostly be found to increase the practical usefulness of the book.

Perhaps the most important change is in the present Part III, on "Pharmaceutical Processes and Apparatus," the subject of which formed a portion of Part V, on "Galenical Pharmacy," and Part III, on "Inorganic Pharmaceutical Chemistry," in former editions. The remaining parts, though necessarily changed in number, remain otherwise as before. The classification of the metals in former editions was based upon their chemical and in a measure upon the medicinal analogy of their compounds; in the present edition they are classed according to their quantivalence. We confess that we prefer the former or some similar plan, though the latter may be apparently more scientific. Chapter V, however, contains several metals which are not tetrads. The subdivision of the part relating to "Organic Chemistry" remains essentially unchanged. Originally suggested by the elder Soubeiran, and necessarily materially modified in the course of time, the classification has peculiar advantages for the pharmaceutical student, and several of the groups are even at the present time considered in a similar manner in systematic works on organic chemistry. But the advances in this branch of science have been very great of late years, and would seem to necessitate greater changes in the introductory portion of several chapters and in some of the syllabi. The volatile oils, neutral principles and alkaloids at present known to exist in plants, and more or less investigated, are so numerous that it seems advisable in a work of this kind to confine their enumeration to medicinal and otherwise important plants.

The part on "Galenical Pharmacy"—notwithstanding several chapters have been transferred to another part, as stated above—has been increased from 240 to over 300 pages. Each page bears evidence of the care bestowed upon it, and conveys valuable information from the rich store of the editor's experience. In fact all that relates to practical pharmacy—apparatus, processes and dispensing—has been conveniently arranged, and described with clearness in its various aspects, so as to afford aid and advice alike to the student and to the practical pharmacist. It is scarcely necessary to mention that the work is judiciously illustrated, with good wood cuts, and is well printed upon good paper.

A Digest of Materia Medica and Pharmacy; forming a complete Pharmacopœia for the use of physicians, druggists, and students. By Albert Merrell, M.D., Professor of Chemistry, Pharmacy, and Toxicology in the American Medical College, St. Louis, Mo., etc. Philadelphia: P. Blakiston, Son & Co., 1883. 8vo, pp. 512.

The work has evidently been written for the use of physicians of the eclectic school. For the professional pharmacist, it contains little that would be of direct use to him, and nothing which he could not find in other works of reference usually on hand, except the strength of eclectic galenical preparations, which, from the position of the author, we presume to be authoritative. The vegetable and animal drugs are merely enumerated, without an attempt of describing them. The constituents of each, when known, are mentioned, and generally very briefly characterized as to their solubilities; but even in this respect the information dates usually back three or four years, and the investigations made in the meantime are not considered, including such important ones as those on the alkaloids of the solanaceæ, the constituents of colchicum, etc. Chemical compounds

are, as a rule, characterized, but entirely insufficient for their recognition. The tests of purity are usually given correctly, although very briefly and without making allowance for admissible impurities. Chrysarobin is still called chrysophanic acid.

About forty pages of the work are devoted to "Pharmacy," which may serve as a guide to physicians supplying their own medicines, but is evidently insufficient to be considered even as a mere sketch of the vocation of a pharmacist. The evident aim at briefness has made the author, in some cases, say what we do not believe he intended to assert. The statement that "alcohol does not dissolve any of the most common non-medicinal principles except chlorophyll," should certainly not be taken to mean that "everything, except chlorophyll, dissolved by alcohol possesses medicinal virtues." The statement is not correct that "water dissolves only part of the medicinal principles enumerated and *all* the non-medicinal." Nor is it correct to say that "the liquid removed (in the preparation of tinctures by maceration) represents the drug in exactly the proportion its weight bears to the menstruum used in maceration," for the principles dissolved by the menstruum necessarily increase the weight of the liquid. It is, however, proper to say that this introductory portion contains many good suggestions, which show that the author is by no means a novice in pharmaceutical manipulations. To the effects and therapeutical uses of the drugs, as described in the work, our remarks do not apply.

The book is well gotten up and will be welcomed by those who may be desirous of acquainting themselves with pharmacy of the eclectic school.

Proceedings of the Fourth Annual Meeting of the Illinois Pharmaceutical Association, held at Springfield, October 9 and 10, 1883. Chicago. 8vo, pp. 108.

An account of the meeting will be found on page 633 of our last number.

The Nelson Price Book Revised. The Druggists' Pocket Price Book, for retailers, jobbers, manufacturers, and traveling salesmen; showing the exact location of every article in the store, cost and selling price, quotations, discounts, etc. Third edition. Entirely rewritten, rearranged, and improved by Benj. Lillard. New York: J. H. Vail & Co. Price, flexible leather, \$3.00.

The contents are arranged in alphabetical order with one marginal index, in which respect, as well as in its greater completeness, it differs from the former edition.

Classification of the Materia Medica Collection of the United States National Museum and Catalogue of Specimens. By James M. Flint, Surgeon U. S. Navy, Curator of the Department of Materia Medica. 8vo, pp. 45.

The articles are classified according to their origin as, 1, animal products; 2, vegetable products; 3, products of fermentation and distillation; 4, inorganic products. The first division is arranged in classes and orders recognized in zoology; the second division according to the botanical system of Bentham and Hooker, and the fourth division under the elements grouped according to Roscoe and Schorlemmer. The catalogue shows that the collection is already a very full one, embracing many specimens, not found in regular commerce.

Index to the Transactions of the American Medical Association, Vols. I-XXXIII. Prepared by Wm. B. Atkinson, M. D., Permanent Secretary. Philadelphia, 1883. 8vo, pp. 130.

A useful and well-prepared general index of these Transactions, which renders the subject-matter contained therein available. Since last year the Association has discontinued the publication of an annual volume, and replaced it by a weekly Journal published under the auspices of the Association, such a general index became very desirable.

OBITUARY.

JOHN ELIOT HOWARD, F.R.S., the celebrated quinologist, died quite unexpectedly on the 22d of November last, at his residence, Lord's Meade, Tottenham, having attained the ripe age of 76 years. He was born December 11, 1807, and, after leaving school, entered the business established by his father, Luke Howard, at Stratford, and carried on under the well-known firm of Howards & Sons. It is not unlikely that the publication of Weddell's important work on the cinchonas, published in 1849, may have more forcibly directed Mr. Howard's attention to this important subject; at any rate, in 1852, he published his first paper on cinchona, an elaborate examination of Pavon's specimens of bark preserved in the British Museum, and from this time until his death he was foremost in the endeavors made to secure to suffering humanity a bountiful supply of this indispensable remedy. He traced the valuable manuscript of Pavon, entitled "Nueva Quinologia," which had remained unnoticed for about 35 years in Spain, and published it in 1862, embellished with 30 beautiful colored plates, drawn by the well-known artist Mr. Fitch, from Pavon's original specimens preserved at Madrid. In the meantime, the Dutch government had sent Hasskarl, and the British government Clements Markham, with several aids, on their mission to the cinchona region, which resulted in the transplantation of the valuable trees to Java and India and afterwards to other countries. For nearly 30 years, and up to the time of his death, Mr. Howard gave all the aid in his power to this important enterprise, and his services were, in 1873, acknowledged in a special vote of thanks from the British government. Of the numerous papers written by him on the subject, to which he devoted so much time and labor, quite a number have been transferred to the pages of this Journal. His illustrated Quinology of the East India Plantations, published in three parts, contains the results of important researches in this field; it forms a most valuable part of the extensive literature on the cinchonas.

For thirty years, Mr. Howard was a member of the Pharmaceutical Society of Great Britain; on the 6th of October last he received the Hanbury gold medal as a recognition of the value of his scientific investigations respecting an important article of *materia medica*. He was also a member of the Linnean Society, the Royal Society, the British Pharmaceutical Conference, and an honorary member of numerous scientific bodies, among them of the Philadelphia College of Pharmacy.

Mr. Howard died after a very brief illness, leaving a large circle of children and grandchildren.

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Trout, Winfield Scott,	Philada.,	Pa.	Van Buskirk & Apple.
Van Buskirk Samuel Levick,	Bethlehem,	Pa.	L. M. Pratt, M. D.
Vannort Wm. Augustus,	Kent,	Md.	F. C. Bourscheidt & Bro.
Von Achen, Frank Herman,	Peoria,	Ill.	D. S. Jones.
Wagner, Geo. Lewis,	Allentown,	Pa.	L. E. Sayre.
Wain, Chas. Herbert,	Yardville,	N. J.	
Ward, Joseph Poletus,	Gaston,	Pa.	S. Douglass.
Watson, Maurice,	Bristol,	Pa.	Geo. Phipps.
Wegener, Henry,	Baraboo,	Wis.	Wood & Wadsworth.
Weisel, Benjamin Franklin,	Elizabeth City,	N. C.	G. I. McKelway.
Whilden, Chas. Bennett,	Charleston,	S. C.	B. H. Diehl.
Whinna, Joseph,	Philada.,	Pa.	J. G. Wells.
Whitney, Heston,	Glassboro,	N. J.	D. L. Witmer & Bro.
Wilkinson, Wm. John,	Philada.,	Pa.	E. T. Meyers.
Williams Neri Barndt,	Easton,	Pa.	T. C. Tomlinson.
Windolph, Frederick, Jr.,	Dover,	Del.	G. D. Bolton.
Wingender, Wendell Philips,	Schuylkill Haven,	Pa.	C. M. Reger.
Winslow, Colburn Thue,	Benezette,	Pa.	L. Wirth.
Wirth, Adolph Leopold,	Milwaukee,	Wis.	E. Lamparter.
Wolff, Louis,	Hessen,	Germany.	T. L. Buckman.
Wood, Alfred Conard,	Hatboro,	Pa.	Avery, Brown & Co.
Woodill, Robert Wellesley,	Halifax,	N. S.	R. R. Stewart, M. D.
Wright, James Edward,	Philada.,	Pa.	W. Stahlner.
Yost, Wm. Oscar,	Norristown,	Pa.	Dr. A. McDonald.
Young, Chas. Thomas,	Round Rock,	Texas.	W. H. Llewellyn.
Young, Robert Taylor,	Philada.,	Pa.	B. H. Herth.
Zieber, Paul,	Hanover,	Pa.	

SENIOR CLASS.

Matriculants.	Town or County.	State.	Preceptor.
Ahon, Joseph William,	Clinton,	Miss.	P. Fitch, M. D.
Adams, Ellsworth Smith,	Beverly,	N. J.	A. W. Taylor, M. D.
Alexander, Fred. Wm.,	Rochester,	N. Y.	F. W. Pfaff.
Allen, Charles Spencer,	Easton,	Pa.	A. J. Odenwelder.
Anderson, Harry Warren,	Bath,	Me.	S. Anderson.
Andrews, Frederick Owen,	Avondale,	Pa.	Geo. Cooke.
Babb, Grace Lee,	Eastport,	Me.	J. P. Remington.
Ball, John Alexis,	Philada.,	Pa.	R. D. Jones, M. D.
Baker, Thomas David,	Lewisburg,	Pa.	Smith, Kline & Co.
Ballinger, Abraham Lincoln,	Medford,	N. J.	C. L. Mitchell & Co.
Barber, Harry Lee,	Philada.,	Pa.	C. E. Spenceley.
Beans, Edwin K., Jr.,	Philada.,	Pa.	M. Goldsmith.
Bender, Wm Piper, Jr.,	Camden,	N. J.	J. R. Augney.
Betts, William Hart,	Pineville,	Pa.	H. C. Blair's Sons.
Bollinger, Charles Wesley,	Apollo,	Pa.	T. A. Cochran.
Bollman, Curtis Jacob,	Mansfield,	Ohio.	D. F. Shull & Co.
Booze, Edgar Ellsworth,	Trenton,	N. J.	Lalor & Mangold.
Boynton, William Carlton,	Auburn,	Me.	Young & Stone.
Bray, Walter S.,	Dexter,	Me.	D. G. Hurley.
Bridgeman, Frank Fred.,	Sheboygan,	Wis.	Geo. Holland.
Briggs, Matt Ashley, Jr.,	Valdosta,	Ga.	R. Thomas & Co.
Brown, Albert Edward,	Mobile,	Ala.	Benj. Ward.
Bullock, William Anthony,	Philada.,	Pa.	Bullock & Crenshaw.
Burt, Walter Colton,	Philada.,	Pa.	Bullock & Crenshaw.
Cadmus, Robert Clark,	Philada.,	Pa.	W. J. McLean.
Carter, Buchanan,	Toisnot,	N. C.	E. H. Kaerccross.

Matriculants.	Town or County.	State.	Preceptor.
Cassell, Wm. Ellsworth,	Harrisburg,	Pa.	F. S. Keet.
Champion, Carleton Cole,	Philada.,	Pa.	Bullock & Crenshaw
Chandler, Isaac Eugene,	Kennett Square,	Pa.	D. W. Hutchison,
Christ, Charles Wesley,	Selins Grove,	Pa.	E. J. Lehman,
Clark, Robert, Jr.,	Philada.,	Pa.	Dr. G. M. Ward,
Clayton, Abraham Theophilus,	Philada.,	Pa.	O. L. Coles,
Cliffe, William Lincoln,	Philada.,	Pa.	J. B. Reynolds,
Cohen, Nathan Alexander,	Philada.,	Pa.	Mussen & Housekeeper,
Colegrove, La Rue Robert,	Elmira,	N. Y.	W. K. Mattern, M. D.
Coleman, John Joseph,	Wheeling,	W. Va.	Chas. Moenkmueller,
Collins, Paul,	Newark,	Ohio.	J. W. Collins & Sons,
Cook, Harry C.,	Columbus,	Ohio.	John R. Cook.
Cook, Wm. Alexander,	Americus,	Ga.	
Cox, Geo. Washington,	Philada.,	Pa.	J. T. White,
Crawford, Joseph,	Philada.,	Pa.	B. F. Babp.
Crawford, Samuel Douglass,	Philada.,	Pa.	J. M. Shoffner,
Cress, Charles Thos. Wm.,	Nazareth,	Pa.	P. S. P. Whiteside & Son,
Custer, John Whiteside,	South Bethlehem,	Pa.	Bullock & Crenshaw.
Dallett, Prosper Martin,	Philada.,	Pa.	J. L. Curry,
Daile, Frederick Augustus,	Reading,	Pa.	J. H. Blake,
Darrach, Francis Leaming,	Philada.,	Pa.	J. M. Wert, M. D.
Davies, John Jenkins,	Scranton,	Pa.	W. C. Bakes,
DeHuy, Bernard H.,	Abilene,	Kan.	D. R. De Long, M. D.
De Long, William Edward,	Bangor,	Pa.	The F. Dohmen Co.
Dohmen, William Fred.,	Milwaukee,	Wis.	M. Eisner,
Drise, Hermann,	San Antonio,	Texas.	L. A. Braddock,
Dutton, William,	Haddonfield,	N. J.	C. Shivers,
Eberle, Eugene Gustav,	Watertown,	Wis.	H. C. Eddy,
Edwards, Chas. Matthew,	Millington,	Md.	W. F. Owen,
Eisenhart, Foster Benjamin,	Philada.,	Pa.	Marcy & Mccray,
Eldridge, Joseph Johnson,	Cape May,	N. J.	S. P. Wright,
Evans, Edmund Hann,	Philada.,	Pa.	C. A. Heinlsh,
Falck, Milton Smoker,	Lancaster,	Pa.	F. Guibourd, M. D.
Falk, John Charles,	St. Genevieve,	Mo.	W. H. Lacey,
Fearheller, Theo.,	Philada.,	Pa.	A. Scherer,
Feldkamp, Charles Louis,	Chicago,	Ill.	B. W. Fettera,
Fetters, Frank Penicks,	Philada.,	Pa.	B. W. Fettera,
Fetters, Wm. Anderson,	Philada.,	Pa.	E. A. Stahler,
Fillman, Eugene Anderman,	Norristown,	Pa.	A. R. Finck, M. D.
Finck, Robert, Fechtig,	Philada.,	Pa.	A. L. Thorn,
Fitzgeorge, Thos.,	Trenton,	N. J.	H. H. Owen,
Fitzpatrick, Philip T.	Lancaster,	Pa.	Dr. J. Howard Owen,
Follmer, Daniel,	Milton,	Pa.	Brown & Dawson,
Fox, Frederick Henry,	Phoenix,	N. Y.	E. H. Kaerccross,
Funk, Francis Marion,	Wausecon,	Ohio.	H. K. Watson,
Gano, Wm. Hubble, Jr.,	Wilmington,	Del.	Dr. Colton,
Gardner, Charles,	Columbus Junction,	Iowa.	R. Shoemaker & Co.
Geiger, Geo. Lambert,	Stanton,	Va.	
Georges, Amandus George,	North Java,	N. Y.	H. S. Barr,
Goldbach, John,	Toledo,	Ohio.	L. C. Funk,
Groff, Frank Barr,	Philada.,	Pa.	J. Wyeth & Bro.
Hall, Humes,	Philada.,	Pa.	J. Wyeth & Bro.
Harper, Robert Newton,	Leesburg,	Va.	
Haus, Charles Morris,	Bethlehem,	Pa.	H. G. Peters,
Headley, Wm. Henry Harrison,	Bristol,	Pa.	Hartzell, Smith & Co.
Heiberger, Eugene Samuel,	Allentown,	Pa.	J. P. Remington,
Heinitsh, Henry Ernest,	Philada.,	Pa.	Bullock & Crenshaw.
Henderson, James Ashton,	Maytown,	Pa.	H. B. Taylor,
Hesson, Robert Lewis,	Philada.,	Pa.	S. E. R. Hassinger,
Hillan, John Michael,	St. Clair,	Pa.	H. Waterman,
Hinckley, Levi Ellsworth,	Chagrin Falls,	Ohio.	S. C. Mieschamp,
Hirst, Levi Brook,	Camden,	N. J.	P. M. Ziegler, M. D.
Hoffman, Ephraim Ziegler,	Maytown,	Pa.	J. J. Karch,
Houck, Calvin Jerome,	Lebanon,	Pa.	S. Gerhard,
Houck, Oscar,	La Crosse,	Wis.	J. Wyeth & Bro.
Howey, John Joseph,	Marshall,	Va.	D. S. Ferguson,
Huff, John Thompson,	Paulsboro,	N. J.	F. E. Himmelmwright,
Ischler, George Herman,	Philada.,	Pa.	S. C. Spalding, M. D.
Johnson, Elmer Ellsworth,	Shenandoah,	Pa.	R. H. Johnston,
Johnston, Thomas Crawford,	Philada.,	Pa.	
Jordan, Abraham,	Philada.,	Pa.	H. S. Bartlett,
Judd, James Frederick,	London,	England.	G. H. Toboldt,
Keller, Fred. Rudolph,	Philada.,	Pa.	S. B. Kieffer, M. D.
Keller, George Dering,	Carlisle,	Pa.	W. H. Irwin,
Keller, John William,	Altoona,	Pa.	F. M. Reed,
Kelley, William Clarence,	Chester,	Pa.	D. L. Stackhouse,
Ketcham, Stephen Rush,	Philada.,	Pa.	B. F. Johnson,
King, Wm., Henri,	Philada.,	Pa.	B. N. Bethel,
Kinsey, Albert Henry,	Gallion,	Ohio.	

Matriculants.	Town or County.	State.	Preceptor.
Klump, George Lewis,	Allentown,	Pa.	C. C. Klump.
Koch, Charles Herman,	Philada.,	Pa.	J. T. Shinn.
Koenig, Wm. Matthew,	R-ading,	Pa.	F. X. Wolf.
Krum, Chas. Franklin,	Catawissa,	Pa.	M. Oswald.
Kusenber, Louis Carl,	Reading,	Pa.	J. B. Raser.
Kutzner, John Douy,	Shamokin,	Pa.	W. R. Kutzner.
Lammer, Francis Joseph,	Philada.,	Pa.	Dr. L. Wolff.
Lawall, Charles Elmer,	Catasauqua,	Pa.	J. S. Lawall.
Lawbach, Wm. Harrison, Jr.,	Catasauqua,	Pa.	J. Wyeth & Bro.
Leeds, Harry Bellerjeau,	Atlantic City,	N. J.	Dr. C. T. Smith.
Leithhead, Robert, Jr.,	Rockland,	Del.	C. H. Clark.
Leonard, Isaac Edward,	White Haven,	Pa.	J. J. Baker, Jr.
Lowe, Clement Belton,	Philada.,	Pa.	
McCarthy, Cornelius Joseph,	Philada.,	Pa.	Bullock & Crenshaw.
McCaul-y, John Sloan,	Philada.,	Pa.	
McCausland, Jas. Ralston,	Philada.,	Pa.	L. E. Sayre.
McConn, Wm. John,	Philada.,	Pa.	Geo. Blinkhorn.
McCoy, Franklin,	Bellville,	Ohio.	J. C. Potts.
McKee, Alexander,	Philada.,	Pa.	J. Wyeth & Bro.
McKenzie, Tracy,	Mexia,	Texas.	Dr. M. W. Kemp.
McVicker, John Clarence,	Morgantown,	W. Va.	J. M. Reed.
Maddock, George Frederick,	Monmouth,	N. J.	C. H. Gubbins.
Maguire, Andrew Herman Joseph,	Engl-nd,		W. C. Bakes.
Maisch Henry Charles Christian,	Philada.,	Pa.	L. Wolf, M. D.
Maitland, Henry Wilbur,	Philada.,	Pa.	L. W. Hildenbrand, M. D
Malatesta, Jos. Mark,	Philada.,	Pa.	J. H. Blake.
Mallon, James P.,	Philada.,	Pa.	M. Bond, M. D.
Martin, Emlen,	Rancocos,	N. J.	Dr. W. L. Martin.
Martin, John Edwin,	Jersey Shore,		C. E. Kanerly, M. D.
Miller, Harry Lovett, Jr.,	Morris,	Ill.	W. H. Miller.
Mitcheson, Robt. Stockton Johnson,	Philada.,	Pa.	W. R. Warner & Co.
Moerk, Frank Xavier,	Wilmington,	Del.	August Kuhlmann.
Moore, Christian,	Ardmore,	Pa.	S. F. Stadelman.
Morris, John Augustine,	Philada.,	Pa.	W. C. Todd, M. D.
Murjahn, Louis,	Philada.,	Pa.	
Murrow, James White,	Philada.,	Pa.	A. M. Wilson.
Murtagh, John Anthony,	Germantown,	Pa.	Wm. Conner.
Nock, Thos. Oliver,	Camden,	Del.	W. B. Nock.
Oberholtzer, Chas. Herman,	Phoenixville,	Pa.	L. Oberholtzers Sons & Co.
Ogilby, Wm.,	Carlisle,	Pa.	H. C. Blair's Sons.
Olmstead, Frank Boyd,	Waterton,	N. Y.	H. H. Rice.
Osborne, Melmouth Mercer,	Philada.,	Pa.	L. E. Sayre.
Owen, Gomer David,	Newark,	Ohio.	L. E. Sayre.
Pancoast, George Widdifield,	Mt. Holly,	N. J.	H. Thornton.
Parrish, Callistus Mitchell,	Ebensburg,	Pa.	W. Lemmon, M. D.
Pattengill, Evan Ingstrum,	Elmira,	N. Y.	C. W. Holmes.
Pemberton, Samuel Lovering,	Philada.,	Pa.	Bullock & Crenshaw.
Perrenot, Emile A.,	Alleghany City,	Pa.	J. A. Heintzelman.
Petrie, Edward Sing,	Oswego,	N. Y.	J. C. Morgan.
Pettigrew, Harlan Page,	Sioux Falls,	Dakota.	L. T. Dunning.
Pierce, Wm. Chandler,	Wilmington,	Del.	Smith & Painter.
Pleuge, Henry Charles,	Charleston,	S. C.	G. J. Luhn.
Pool, James Arthur,	Earlville,	Ill.	J. J. Pool.
Preston, Edmund, Jr.,	Fallston,	Md.	W. Procter Jr. Co.
Prickitt, Elmer Delaney,	Mt. Holly,	N. J.	Louis Miller.
Reading, Wm. Van Dyke,	Norristown,	Pa.	F. H. Poley.
Reese, Berch Taylor,	Philada.,	Pa.	W. R. Warner & Co.
Reisert, William,	Philada.,	Pa.	A. H. C. Rowand.
Ridington, Wm. Augustus,	Conshohocken,	N. J.	Wm. McKenzie, M. D.
Riggs, Elias Ellsworth,	Hightstown,	N. J.	G. E. Titus, M. D.
Ritter, Charles Templeton,	Allentown,	Pa.	H. C. Walker.
Rohrer, Joshua Ellis,	Carlisle,	Pa.	J. B. Haverstick.
Rumsey, Walter Arabin,	Salem,	N. J.	D. E. Rice, M. D.
Ryan, Frank Gibbs,	Elmira,	N. Y.	Brown & Dawson.
Santee, Andrew Curtin,	Town Line,	Pa.	J. M. Wert.
Schroder, Luther John-on,	Columbia,	Pa.	P. S. Brugh.
Schuldt, Henry Francis,	Philada.,	Pa.	J. L. Supplee.
Schwartz, Frederick,	Philada.,	Pa.	E. W. Herrmann.
Sharp, Edward Wolf,	Seaville,	N. J.	F. M. Reed.
Sher, Fred P.,	Philada.,	Pa.	Dr. Sher.
Sherman, Austin Charles,	Girardville,	Pa.	Z. T. Trout.
Singer, Wm. August,	Peoria,	Ill.	A. C. Drewitz.
Smith, Christopher Columbus,	Philada.,	Pa.	J. F. Wilgus.
Smith, James Oscar,	Eldorado,	Ark.	L. Wolf, M. D.
Snyder, Harry Lincoln,	Mechanicsburg,	Pa.	H. A. Borell.
Spangler, George Ellsworth,	Lebanon,	Pa.	Hansell & Bro.
Stager, Edwin Wesley,	Lebanon,	Pa.	J. A. Armstrong, M.D.
Stahl, Benjamin Franklin,	Marietta,	Pa.	Funk & Spencer.
Steinmetz, Charles Maye,	Readin g,	Pa.	Ed. Wa- rington.
Stiles, Henry Lippincott,	Morestown,	N. J.	J. B. Stevenson.

Matriculants.	Town or County.	State.	Preceptor.
Strasser, John Jacob, Jr.,	Trenton,	N. J.	F. R. Jummel.
Streitz, Alexander Frederick,	North Platte,	Neb.	J. A. Le Fils.
Sypherd, Clarence Draper,	Sadlersville,	Md.	W. A. Higgate, M. D.
Tatem, Henry Randolph,	Collingswood,	N. J.	Conrad & Co.
Tedford, Edward Weeks,	Maryville,	Tenn.	Dr. Arbeely.
Thomas, James Harry,	Philada.,	Pa.	F. Brown.
Thompson, William Cochran,	Coatesville,	Pa.	G. W. Davy.
Trefry, Thomas Crowell,	Yarmouth,	N. S.	Dr. C. A. Black.
Trist, Edwin Allen,	Philada.,	Pa.	Bullock & Crenshaw.
Trout, John Henry,	Chester,	Pa.	J. R. Kauffman.
Urban, Fred, Lang,	Pittsburg,	Pa.	A. B. Urben.
Valentine, Frank Elliott,	Urbana,	Ohio.	F. S. Case.
Vaughan, Parry Wyche,	Durham,	N. C.	
Ward, John Martin Broomall,	Chester,	Pa.	G. Banks Wilson.
Watson, Wm. Porter,	Clearfield,	Pa.	C. D. Watson.
Weaber, John Alvin,	Fredericksburg,	Pa.	R. B. Heilman.
Weber, Alexander Arthur,	Mahonoy City,	Pa.	J. A. Parker.
Webb, Richard, John,	Scranton,	Pa.	Dr. J. L. Rea.
Webster, Samuel C.,	Philada.,	Pa.	G. C. Webster.
Weirich, George Alcinus,	Minersville,	Pa.	P. A. Bissell.
Wenner, Alfred Jefferson,	Allentown,	N. J.	C. G. Hoell, M. D.
Wetteroth, Henry,	Bordentown,	N. J.	Bunting Hankins.
Wickham, Anthony Smith,	Wheeling,	W. Va.	H. B. Taylor.
Wilgus William Alcott,	Bordentown,	Pa.	J. F. Wilgus.
Williams, George Thomas,	Wilmington,	Del.	P. H. Wood.
Wilson, Elmer Ellsworth,	Bucks Co.,	Pa.	Dotts, Beale & Lambert.
Wirth, Adolph Leopold,	Milwaukee,	Wis.	L. Wirth.
Wittiger, Hugo Ottiger,	Bethlehem,	Pa.	J. N. Shoffner.